PROJECT MANUAL

FOR

BRANDYWINE SCHOOL DISTRICT

CLAYMONT ELEMENTARY SCHOOL RENOVATION

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ABHA PROJECT NUMBER: 1630
DATE: November 7, 2018

BID PAC B
ISSUED FOR BID
Volume 2 of 2
Divisions 2 - 34

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SECTION 02 41 00
DEMOLITION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Selective demolition of building elements for alteration purposes.

1.02 RELATED REQUIREMENTS

A. Section 01 10 00 - Summary: Limitations on Contractor's use of site and premises.

B. Section 01 10 00 - Summary: Description of items to be removed by Owner.

C. Section 01 50 00 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.

D. Section 01 60 00 - Product Requirements: Handling and storage of items removed for salvage and relocation.

E. Section 01 70 00 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.

F. Section 01 74 19 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.

G. Section 31 23 23 - Fill: Fill material for filling holes, pits, and excavations generated as a result of removal operations.

1.03 REFERENCE STANDARDS

A. 29 CFR 1926 - U.S. Occupational Safety and Health Standards; current edition.

B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2013.

1.04 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Permits and notices authorizing demolition.

C. Certificates of severance of utility services.

D. Permit for transport and disposal of debris.

E. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

1.05 QUALITY ASSURANCE

A. Demolition Firm Qualifications: Company specializing in the type of work required.

PART 2 PRODUCTS

2.01 MATERIALS

A. Except where noted otherwise, maintain possession of materials being demolished. Immediately remove from site.

B. Relics and antiques (i.e. cornerstones and their contents, commemorative plaques, and tablets) and similar objects remain the property of the Owner. Notify Architect prior to removal and obtain acceptance regarding method of removal.

PART 3 EXECUTION

3.01 PREPARATION

A. Erect weatherproof closures for exterior openings. Maintain exit requirements.

B. Erect and maintain dustproof partitions as required to prevent spread of dust, fumes and smoke to other parts of the building. On completion, remove partitions and repair damaged surfaces to match adjacent surfaces.

C. Provide proper protection from falling objects over entrances which are to be kept open during normal working hours.

D. Locate guard rails in stairwells and around open shafts to protect workers. Post clearly visible warning signs.

E. Carry out demolition work to cause as little inconvenience to adjacent occupied building areas as possible.

3.02 SCOPE

A. Demolish in an orderly and careful manner as required to accommodate new work. Protect existing foundations and supporting structural members.

B. Repair all demolition performed in excess of that required, at no cost to the Owner.

C. Burning of in-place or demolished materials on site is not permitted.

D. Remove other items indicated, for salvage, relocation, and recycling.

E. Fill excavations, open pits, and holes in ground areas generated as result of removals, using specified fill; compact fill as specified in Section 31 22 00.

3.03 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
   1. Obtain required permits.
   2. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
   3. Provide, erect, and maintain temporary barriers and security devices.
   4. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
   5. Do not close or obstruct roadways or sidewalks without permit.
   6. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
   7. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.

B. Do not begin removal until receipt of notification to proceed from Owner.

C. Protect existing structures and other elements that are not to be removed.
   1. Provide bracing and shoring.
   2. Prevent movement or settlement of adjacent structures.

3. Stop work immediately if adjacent structures appear to be in danger.

3.04 SELECTIVE DEMOLITION FOR ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
   1. Verify that construction and utility arrangements are as indicated.
   2. Report discrepancies to Architect before disturbing existing installation.
   3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.

B. Separate areas in which demolition is being conducted from other areas that are still occupied.
   1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 50 00 in locations indicated on drawings.

C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.

D. Remove existing work as indicated and as required to accomplish new work.
   1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction specified.
   2. Remove items indicated on drawings.

E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove existing systems and equipment as indicated.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
   2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
   3. Verify that abandoned services serve only abandoned facilities before removal.
   4. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification.

F. Protect existing work to remain.
   1. Prevent movement of structure; provide shoring and bracing if necessary.
   2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
   3. Repair adjacent construction and finishes damaged during removal work.
   4. Patch as specified for patching new work.

3.05 DEBRIS AND WASTE REMOVAL

A. Remove debris, junk, and trash from site.

B. Leave site in clean condition, ready for subsequent work.

C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

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SECTION 03 20 00
CONCRETE REINFORCING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Reinforcing steel for cast-in-place concrete.

B. Supports and accessories for steel reinforcement.

1.02 RELATED REQUIREMENTS

A. Section 01 74 19 – Construction Waste Management

B. Section 01 81 13 – Sustainable Design Requirements

C. Section 03 30 00 - Cast-in-Place Concrete.

D. Section 04 20 00 - Unit Masonry: Reinforcement for masonry.

1.03 LEED REQUIREMENTS

A. LEED Focus Materials (LFMs) For This Section
   1. Targeted products containing Recycled Content (MRc4)
   2. Targeted products containing Regional Material (MRc5)

1.04 REFERENCE STANDARDS

A. ACI 301 - Specifications for Structural Concrete; 2016.

B. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2014 (Errata 2016).

C. ASTM A184/A184M - Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement; 2017.

D. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2016.

E. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2017.

F. AWS D1.4/D1.4M - Structural Welding Code - Reinforcing Steel; 2011.

1.05 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Shop Drawings: Include bar schedules, shapes of bent bars, spacing of bars, and location of splices.

C. LEED Product and Material Data Summary Form: For all installed products and materials of this Section, complete the "LEED Product and Material Data Summary Form" (attached to end of Section 01 81 13 - Sustainable Design Requirements)
   1. Product Material Cost: Provide the cost for material, or an assembled product, including taxes and delivery but excluding any cost for labor and equipment required for installation after the material is delivered to the site.
   2. Product Data for Credit MRc4, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating cost for each product having recycled content.

3. Product Data for Credit MRc5, Regional Material: For products having regional materials, documentation indicating location of raw material extraction, harvest or recovery, as well as, manufacture (location of final assembly) within 500 miles of project site. Include statement indicating cost for each material or component of the assembled product.

1.06 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301 and ACI 318.

B. Welders' Certificates: Submit certifications for welders employed on the project, verifying AWS qualification within the previous 12 months.

C. Sustainability and LEED Standards Certification:
   1. Regional manufactured products with percentage by weight.
   2. Recycled content calculated as 1/2 preconsumer + postconsumer.

PART 2 PRODUCTS

2.01 REINFORCEMENT

A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi).
   1. Deformed billet-steel bars.

B. Stirrup Steel: ASTM A1064/A1064M steel wire, unfinished.

C. Steel Welded Wire Reinforcement (WWR): Plain type; ASTM A1064/A1064M.
   1. Form: Flat Sheets.
   2. WWR Style: As indicated on drawings.

D. Reinforcement Accessories:
   1. Tie Wire: Annealed, minimum 16 gage, 0.0508 inch.
   2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.

2.02 FABRICATION

A. Fabricate concrete reinforcing in accordance with ACI 318.

B. Welding of reinforcement is permitted only with the specific approval of Architect. Perform welding in accordance with AWS D1.4/D1.4M.

PART 3 EXECUTION

3.01 PLACEMENT

A. Place, support and secure reinforcement against displacement. Do not deviate from required position.

B. Do not displace or damage vapor barrier.

C. Accommodate placement of formed openings.

D. Maintain concrete cover around reinforcing as follows:
   1. Column Ties: 1-1/2 inches.
   2. Walls (exposed to weather or backfill): 1-1/2 inches.
   3. Footings and Concrete Formed Against Earth: 3 inches.
   4. Slabs on Fill: 2 inches.

3.02 FIELD QUALITY CONTROL

A. An independent testing agency, as specified in Section 01 40 00, will inspect installed reinforcement for conformance to contract documents before concrete placement.

END OF SECTION

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SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete formwork.

B. Elevated concrete slabs.

C. Floors and slabs on grade.

D. Concrete foundation walls.

E. Concrete foundations and anchor bolts.

1.02 RELATED REQUIREMENTS

A. Section 01 74 19 – Construction Waste Management.

B. Section 01 81 13 – Sustainable Design Requirements.

C. Section 03 20 00 - Concrete Reinforcing.

D. Section 07 92 00 - Joint Sealants: Products and installation for sealants and joint fillers for saw cut joints and isolation joints in slabs.

1.03 LEED REQUIREMENTS

A. LEED Focus Materials (LFMs) For This Section
   1. Targeted products containing Recycled Content (MRc4)
   2. Targeted products containing Regional Material (MRc5)

1.04 REFERENCE STANDARDS

A. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials; 2010.

B. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; 1991 (Reapproved 2009).

C. ACI 301 - Specifications for Structural Concrete; 2016.

D. ACI 302.1R - Guide for Concrete Floor and Slab Construction; 2004 (Errata 2007).

E. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000.

F. ACI 305R - Guide to Hot Weather Concreting; 2010.

G. ACI 306R - Cold Weather Concreting; 2010.

H. ACI 308R - Guide to Curing Concrete; 2001 (Reapproved 2008).

I. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2014 (Errata 2016).

J. ACI 347R - Guide to Formwork for Concrete; 2014.

K. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2016.

L. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2017.

M. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2016.

N. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2016b.

O. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2016a.

P. ASTM C150/C150M - Standard Specification for Portland Cement; 2016.

Q. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete; 2016.

R. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2016.

S. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a (Reapproved 2016).

T. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2011.

U. ASTM C330/C330M - Standard Specification for Lightweight Aggregates for Structural Concrete; 2014.

V. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2016.

W. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2015.

X. ASTM C1059/C1059M - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete; 2013.

Y. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures; 2015.

Z. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types); 2004 (Reapproved 2013).

AA. ASTM E1155 - Standard Test Method for Determining F(F) Floor Flatness and F(L) Floor Levelness Numbers; 2014.

AB. ASTM E1155M - Standard Test Method for Determining F(F) Floor Flatness and F(L) Floor Levelness Numbers (Metric); 2014.

AC. ASTM E1643 - Standard Practice for Selection, Design, Installation and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs; 2011.

AD. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 2011.

AE. COE CRD-C 513 - COE Specifications for Rubber Waterstops; 1974.

AF. NSF 61 - Drinking Water System Components - Health Effects; 2016.

AG. NSF 372 - Drinking Water System Components - Lead Content; 2016.

1.05 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.

C. Mix Design: Submit proposed concrete mix design.
   1. Indicate proposed mix design complies with requirements of ACI 301, Section 4 - Concrete Mixtures.

2. Indicate proposed mix design complies with requirements of ACI 318, Chapter 5 - Concrete Quality, Mixing and Placing.

D. Samples: Submit samples of underslab vapor retarder to be used.

E. Samples: Submit two, 12 inch long samples of waterstops.

F. Manufacturer's Installation Instructions: For concrete accessories, indicate installation procedures and interface required with adjacent construction.

G. Sustainable Design Submittal: If any fly ash, ground granulated blast furnace slag, silica fume, rice hull ash, or other waste material is used in mix designs to replace Portland cement, submit the total volume of concrete cast in place, mix design(s) used showing the quantity of portland cement replaced, reports showing successful cylinder testing, and temperature on day of pour if cold weather mix is used; use LEED New Product Content Form.

H. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.

I. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

J. LEED Product and Material Data Summary Form: For all installed products and materials of this Section, complete the “LEED Product and Material Data Summary Form” (attached to end of Section 01 81 13 - Sustainable Design Requirements)
   1. Product Material Cost: Provide the cost for material, or an assembled product, including taxes and delivery but excluding any cost for labor and equipment required for installation after the material is delivered to the site.
   2. Product Data for Credit MRc4, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating cost for each product having recycled content.
   3. Product Data for Credit MRc5, Regional Material: For products having regional materials, documentation indicating location of raw material extraction, harvest or recovery, as well as, manufacture (location of final assembly) within 500 miles of project site. Include statement indicating cost for each material or component of the assembled product.

1.06 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301 and ACI 318.

B. Follow recommendations of ACI 305R when concreting during hot weather.

C. Follow recommendations of ACI 306R when concreting during cold weather.

D. For slabs required to include moisture vapor reduction admixture (MVRA), do not proceed with placement unless manufacturer's representative is present for every day of placement.

E. Sustainability and LEED Standards Certification:
   1. Regional manufactured products with percentage by weight.
   2. Recycled content calculated as 1/2 preconsumer + postconsumer.

1.07 WARRANTY

A. See Section 01 77 00 - Closeout Procedures, for additional warranty requirements.

B. Slabs with Moisture Vapor Reducing Admixture (MVRA): Provide warranty to cover the cost of flooring failures due to moisture migration from slabs for ten years.
   1. Include cost of repair or removal of failed flooring, placement of topical moisture remediation system, and replacement of flooring with comparable flooring system.
   2. Provide warranty by manufacturer of MVRA matching terms of flooring adhesive or primer manufacturer's material defect warranty.

C. Moisture Emission Reducing Curing and Sealing Compound: Provide warranty to cost of flooring delamination failures for 10 years.
   1. Include cost of repair or removal of failed flooring, remediation with a moisture vapor impermeable surface coating, and replacement of flooring with comparable flooring system.

PART 2 PRODUCTS

2.01 FORMWORK

A. Formwork Design and Construction: Comply with guidelines of ACI 347R to provide formwork that will produce concrete complying with tolerances of ACI 117.

B. Form Materials: Contractor's choice of standard products with sufficient strength to withstand hydrostatic head without distortion in excess of permitted tolerances.
   1. Form Facing for Exposed Finish Concrete: Contractor's choice of materials that will provide smooth, stain-free final appearance.
   2. Form Coating: Release agent that will not adversely affect concrete.
   3. Form Ties: Cone snap type that will leave no metal within 1-1/2 inches of concrete surface.

2.02 REINFORCEMENT

A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi).
   1. Type: Deformed billet-steel bars.
   2. Finish: Unfinished, unless otherwise indicated.

B. Steel Welded Wire Reinforcement (WWR): Plain type, ASTM A1064/A1064M.
   1. Form: Flat Sheets.
   2. WWR Style: As indicated on drawings.

C. Reinforcement Accessories:
   1. Tie Wire: Annealed, minimum 16 gage, 0.0508 inch.
   2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.

2.03 CONCRETE MATERIALS

A. Cement: ASTM C150/C150M, Type I - Normal Portland type.
   1. Acquire cement for entire project from same source.

B. Fine and Coarse Aggregates: ASTM C 33.
   1. Acquire aggregates for entire project from same source.

C. Lightweight Aggregate: ASTM C330/C330M.

D. Fly Ash: ASTM C618, Class C or F.

E. Silica Fume: ASTM C1240, proportioned in accordance with ACI 211.1.

F. Water: Clean and not detrimental to concrete.

2.04 ADMIXTURES

A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.

B. Air Entrainment Admixture: ASTM C260/C260M.

2.05 ACCESSORY MATERIALS

A. Underslab Vapor Retarder: Sheet material complying with ASTM E1745, Class A; stated by manufacturer as suitable for installation in contact with soil or granular fill under concrete slabs. The use of single ply polyethylene is prohibited.
   1. Installation: Comply with ASTM E1643.
   2. Accessory Products: Vapor retarder manufacturer's recommended tape, adhesive, mastic, prefabricated boots, etc., for sealing seams and penetrations.
   3. Manufacturers:
      a. Fortifiber Building Systems Group; Moistop Ultra 15: www.fortifiber.com/#sle.
      b. Stego Industries, LLC: www.stegoindustries.com/#sle.
      c. W. R. Meadows, Inc; PERMINATOR Class A - 15 mils: www.wrmeadows.com/#sle.

2.06 BONDING AND JOINTING PRODUCTS

A. Latex Bonding Agent: Non-redispersable acrylic latex, complying with ASTM C1059/C1059M, Type II.

B. Waterstops: Rubber, complying with COE CRD-C 513.
   1. Configuration: As indicated on the drawings.
   2. Size: As indicated on the drawings.

C. Slab Isolation Joint Filler: 1/2 inch thick, height equal to slab thickness, with removable top section that will form 1/2 inch deep sealant pocket after removal.
   1. Material: ASTM D1751, cellulose fiber.

2.07 CURING MATERIALS

A. Curing Compound, Naturally Dissipating: Clear, water-based, liquid membrane-forming compound; complying with ASTM C309.
   1. Product dissipates within 7 to 10 days.
   2. Manufacturers:
      a. Dayton Superior Corporation; Clear Cure VOC J7WB: www.daytonsuperior.com/#sle.
      b. Kaufman Products Inc; Thinfilm 420 Resin Base: www.kaufmanproducts.net/#sle.

B. Moisture-Retaining Sheet: ASTM C171.
   1. Curing paper, regular.

2.08 CONCRETE MIX DESIGN

A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.
   1. Replace as much Portland cement as possible with fly ash, ground granulated blast furnace slag, silica fume, or rice hull ash as is consistent with ACI recommendations.

B. Concrete Strength: Establish required average strength for concrete on the basis of field experience, as specified in ACI 301.

1. For trial mixtures method, employ independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.

C. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended or required by manufacturer.

D. Normal Weight Concrete:
1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: As indicated on drawings.
2. Fly Ash Content: Maximum 15 percent of cementitious materials by weight.
3. Silica Fume Content: Maximum 5 percent of cementitious materials by weight.
4. Water-Cement Ratio: Maximum 40 percent by weight.
5. Total Air Content: 4 percent, determined in accordance with ASTM C173/C173M.
6. Maximum Slump: 3 inches.
7. Maximum Aggregate Size: 3/4 inch.

2.09 MIXING

A. Transit Mixers: Comply with ASTM C94/C94M.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.02 PREPARATION

A. Formwork: Comply with requirements of ACI 301. Design and fabricate forms to support all applied loads until concrete is cured, and for easy removal without damage to concrete.

B. Verify that forms are clean and free of rust before applying release agent.

C. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent in according to bonding agent manufacturer's instructions.
1. Use latex bonding agent only for non-load-bearing applications.

D. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade. Lap joints minimum 6 inches. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before covering.
1. Vapor Retarder Over Granular Fill: Install compactible granular fill before placing vapor retarder as indicated on the drawings. Do not use sand.

3.03 INSTALLING REINFORCEMENT AND OTHER EMBEDDED ITEMS

A. Comply with requirements of ACI 301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection.

B. Install welded wire reinforcement in maximum possible lengths, and offset end laps in both directions. Splice laps with tie wire.

C. Verify that anchors, seats, plates, reinforcement and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with concrete placement.

3.04 PLACING CONCRETE

A. Place concrete in accordance with ACI 304R.

B. Place concrete for floor slabs in accordance with ACI 302.1R.

C. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

D. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.

E. Place concrete continuously without construction (cold) joints wherever possible; where construction joints are necessary, before next placement prepare joint surface by removing laitance and exposing the sand and sound surface mortar, by sandblasting or high-pressure water jetting.

F. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

3.05 SLAB JOINTING

A. Locate joints as indicated on the drawings.

B. Anchor joint fillers and devices to prevent movement during concrete placement.

C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.
   1. Install wherever necessary to separate slab from other building members, including columns, walls, equipment foundations, footings, stairs, manholes, sumps, and drains.

D. Saw Cut Contraction Joints: Saw cut joints before concrete begins to cool, within 4 to 12 hours after placing; use 3/16 inch thick blade and cut at least 1 inch deep but not less than one quarter (1/4) the depth of the slab.

3.06 FLOOR FLATNESS AND LEVELNESS TOLERANCES

A. An independent testing agency, as specified in Section 01 40 00, will inspect finished slabs for conformance to specified tolerances.

B. Minimum F(F) Floor Flatness and F(L) Floor Levelness Values:
   1. Exposed to View and Foot Traffic: F(F) of 20; F(L) of 15, on-grade only.
   2. Under Thick-Bed Tile: F(F) of 20; F(L) of 15, on-grade only.
   3. Under Carpeting: F(F) of 25; F(L) of 20, on-grade only.
   4. Under Thin Resilient Flooring and Thinset Tile: F(F) of 35; F(L) of 25, on-grade only.

C. Measure F(F) Floor Flatness and F(L) Floor Levelness in accordance with ASTM E1155 (ASTM E1155M), within 48 hours after slab installation; report both composite overall values and local values for each measured section.

D. Correct the slab surface if composite overall value is less than specified and if local value is less than two-thirds of specified value or less than F(F) 13/F(L) 10.

E. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.07 CONCRETE FINISHING

A. Repair surface defects, including tie holes, immediately after removing formwork.

B. Exposed Form Finish: Rub down or chip off and smooth fins or other raised areas 1/4 inch or more in height. Provide finish as follows:
   1. Smooth Rubbed Finish: Wet concrete and rub with carborundum brick or other abrasive, not more than 24 hours after form removal.

C. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:

1. Surfaces to Receive Thin Floor Coverings: "Steel trowel" as described in ACI 302.1R; thin floor coverings include carpeting, resilient flooring, seamless flooring, resinous matrix terrazzo, thin set quarry tile, and thin set ceramic tile.
2. Other Surfaces to Be Left Exposed: Trowel as described in ACI 302.1R, minimizing burnish marks and other appearance defects.

3.08 CURING AND PROTECTION

A. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

C. Formed Surfaces: Cure by moist curing with forms in place for full curing period.

D. Surfaces Not in Contact with Forms:
1. Slabs and Floors To Receive Adhesive-Applied Flooring: Curing compounds and other surface coatings are usually considered unacceptable by flooring and adhesive manufacturers. If such materials must be used, either obtain the approval of the flooring and adhesive manufacturers prior to use or remove the surface coating after curing to flooring manufacturer's satisfaction.
2. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than three days by water ponding, water-saturated sand, water-fog spray, or saturated burlap.
3. Final Curing: Begin after initial curing but before surface is dry.

3.09 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.

B. Provide free access to concrete operations at project site and cooperate with appointed firm.

C. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.

D. Tests of concrete and concrete materials may be performed at any time to ensure conformance with specified requirements.

E. Compressive Strength Tests: ASTM C39/C39M, for each test, mold and cure three concrete test cylinders. Obtain test samples for every 100 cubic yards or less of each class of concrete placed.

F. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.

3.10 DEFECTIVE CONCRETE

A. Test Results: The testing agency shall report test results in writing to Architect and Contractor within 24 hours of test.

B. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.

C. Repair or replacement of defective concrete will be determined by the Architect. The cost of additional testing shall be borne by Contractor when defective concrete is identified.

D. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Architect for each individual area.

3.11 PROTECTION

A. Do not permit traffic over unprotected concrete floor surface until fully cured.

END OF SECTION

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SECTION 04 05 11
MORTAR AND MASONRY GROUT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Mortar for masonry.

B. Grout for masonry.

1.02 RELATED REQUIREMENTS

A. Section 04 20 00 - Unit Masonry: Installation of mortar and grout.

1.03 REFERENCE STANDARDS

A. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.

B. ASTM C5 - Standard Specification for Quicklime for Structural Purposes; 2010.

C. ASTM C91/C91M - Standard Specification for Masonry Cement; 2012.

D. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2016a.

E. ASTM C150/C150M - Standard Specification for Portland Cement; 2016.

F. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2006 (Reapproved 2011).

G. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2014a.

H. ASTM C387/C387M - Standard Specification for Packaged, Dry, Combined Materials for Concrete and High Strength Mortar; 2015.

I. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2011.

J. ASTM C476 - Standard Specification for Grout for Masonry; 2016.

K. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2016a.

L. ASTM C1019 - Standard Test Method for Sampling and Testing Grout; 2016.

M. ASTM C1072 - Standard Test Method for Measurement of Masonry Flexural Bond Strength; 2013.

N. ASTM C1142 - Standard Specification for Extended Life Mortar for Unit Masonry; 1995 (Reapproved 2013).

O. ASTM C1314 - Standard Test Method for Compressive Strength of Masonry Prisms; 2016.

P. ASTM E518/E518M - Standard Test Methods for Flexural Bond Strength of Masonry; 2015.

1.04 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Product Data: Include design mix and indicate whether the Proportion or Property specification of ASTM C270 is to be used.

C. Reports: Submit reports on mortar indicating conformance of mortar to property requirements of ASTM C270.

D. Reports: Submit reports on grout indicating conformance of component grout materials to requirements of ASTM C476.

1.05 QUALITY ASSURANCE

A. Comply with provisions of TMS 402/602, except where exceeded by requirements of the contract documents.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Maintain packaged materials clean, dry, and protected against dampness, freezing, and foreign matter.

1.07 FIELD CONDITIONS

A. Cold and Hot Weather Requirements: Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

PART 2 PRODUCTS

2.01 MORTAR AND GROUT APPLICATIONS

A. At Contractor's option, mortar and grout may be field-mixed from packaged dry materials, made from factory premixed dry materials with addition of water only, or ready-mixed.

B. Mortar Mix Designs: ASTM C270, Property Specification.
   1. Masonry below grade and in contact with earth: Type S, and M.
   2. Exterior, Loadbearing Masonry: Type S, and M.
   3. Interior, Loadbearing Masonry: Type S, and M.

C. Grout Mix Designs:
   1. Bond Beams: 3,000 psi strength at 28 days; 8-10 inches slump; mix in accordance with ASTM C476.
   2. Engineered Masonry: 3,000 psi strength at 28 days; 8-10 inches slump; mix in accordance with ASTM C476.

2.02 MATERIALS

A. Packaged Dry Material for Mortar for Unit Masonry: Premixed Portland cement, hydrated lime, and sand; complying with ASTM C387/C387M and capable of producing mortar of the specified strength in accordance with ASTM C270 with the addition of water only.
   1. Type: Types as scheduled in this section.

B. Packaged Dry Material for Grout for Masonry: Premixed cementitious materials and dried aggregates; capable of producing grout of the specified strength in accordance with ASTM C476 with the addition of water only.
   1. Type: Fine.

C. Portland Cement: ASTM C150/C150M.
   1. Type: Type I - Normal; ASTM C150/C150M.

D. Masonry Cement: ASTM C91/C91M.
   1. Type: Types as scheduled in this section; ASTM C91/C91M.

E. Hydrated Lime: ASTM C207, Type S.

F. Quicklime: ASTM C5, non-hydraulic type.

G. Mortar Aggregate: ASTM C144.

H. Grout Aggregate: ASTM C404.

I. Water: Clean and potable.

2.03 MORTAR MIXING

A. Ready Mixed Mortar: ASTM C1142, Type equivalent to that specified according to ASTM C270.

B. Thoroughly mix mortar ingredients in accordance with ASTM C270 and in quantities needed for immediate use.

C. Maintain sand uniformly damp immediately before the mixing process.

D. Add admixtures in accordance with manufacturer's instructions; mix uniformly.

E. Do not use anti-freeze compounds to lower the freezing point of mortar.

F. If water is lost by evaporation, re-temper only within two hours of mixing.

2.04 GROUT MIXING

A. Mix grout in accordance with ASTM C94/C94M.

B. Thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C476 for fine grout.

C. Add admixtures in accordance with manufacturer's instructions; mix uniformly.

D. Do not use anti-freeze compounds to lower the freezing point of grout.

2.05 PRECONSTRUCTION TESTING

A. Testing will be conducted by an independent test agency, in accordance with provisions of Section 01 40 00 - Quality Requirements.

B. Mortar Mixes: Test mortars prebatched by weight in accordance with ASTM C780 recommendations for preconstruction testing.

C. Grout Mixes: Test grout batches in accordance with ASTM C1019 procedures.

PART 3 EXECUTION

3.01 PREPARATION

A. Plug clean-out holes for grouted masonry with brick, and block masonry units. Brace masonry to resist wet grout pressure.

3.02 INSTALLATION

A. Install mortar and grout to requirements of section(s) in which masonry is specified.

3.03 GROUTING

A. Use either high-lift or low-lift grouting techniques, at Contractor's option, subject to other limitations of contract documents.

B. Low-Lift Grouting:
   1. Limit height of pours to 12 inches.
   2. Limit height of masonry to 16 inches above each pour.
   3. Pour grout only after vertical reinforcing is in place; place horizontal reinforcing as grout is poured. Prevent displacement of bars as grout is poured.
   4. Place grout for each pour continuously and consolidate immediately; do not interrupt pours for more than 1-1/2 hours.

C. High-Lift Grouting:

1. Verify that horizontal and vertical reinforcement is in proper position and adequately secured before beginning pours.
2. Hollow Masonry: Limit lifts to maximum 4 feet and pours to maximum height of 24 feet.
3. Place grout for spanning elements in single, continuous pour.

3.04 FIELD QUALITY CONTROL

A. An independent testing agency will perform field tests, in accordance with provisions of Section 01 40 00 - Quality Requirements.

B. Test and evaluate mortar in accordance with ASTM C780 procedures.

C. Test and evaluate grout in accordance with ASTM C1019 procedures.

D. Prism Tests: Test masonry and mortar panels for compressive strength in accordance with ASTM C1314, and for flexural bond strength in accordance with ASTM C1072 or ASTM E518/E518M; perform tests and evaluate results as specified in individual masonry sections.

END OF SECTION

SECTION 04 20 00
UNIT MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete Block.

B. Clay Facing Brick.

C. Mortar and Grout.

D. Reinforcement and Anchorage.

E. Lintels.

F. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 01 74 19 – Construction Waste Management

B. Section 01 81 13 – Sustainable Design Requirements

C. Section 04 05 11 - Mortar and Masonry Grout.

D. Section 04 72 00 - Cast Stone Fabrications

E. Section 05 50 00 - Metal Fabrications: Loose steel lintels.

F. Section 07 11 13 - Bituminous Dampproofing: Dampproofing masonry surfaces.

G. Section 07 13 00 - Sheet Waterproofing: Waterproofing masonry surfaces

H. Section 07 21 00 - Thermal Insulation: Insulation for cavity spaces.

I. Section 07 62 00 - Sheet Metal Flashing and Trim: Through-wall masonry flashings.

J. Section 07 84 00 - Firestopping: Firestopping at penetrations of fire-rated masonry and at top of fire-rated walls.

K. Section 07 92 00 - Joint Sealants: Sealing control and expansion joints.

1.03 LEED REQUIREMENTS

A. LEED Focus Materials (LFMs) For This Section
   1. Targeted products containing Recycled Content (MRc4)
   2. Targeted products containing Regional Material (MRc5)

1.04 PRICE AND PAYMENT PROCEDURES

A. See Section 01 23 00 - Alternates, for alternates affecting this section.

1.05 REFERENCE STANDARDS

A. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

C. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2016.

D. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2017.

E. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units; 2016.

F. ASTM C140/C140M - Standard Test Methods of Sampling and Testing Concrete Masonry Units and Related Units; 2016.

G. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2011.

H. ASTM C150/C150M - Standard Specification for Portland Cement; 2016.

I. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2006 (Reapproved 2011).

J. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made From Clay or Shale); 2016.

K. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2011.

L. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2016a.

M. ASTM C1072 - Standard Test Method for Measurement of Masonry Flexural Bond Strength; 2013.

N. ASTM C1148 - Standard Test Method for Measuring the Drying Shrinkage of Masonry Mortar; 1992a (Reapproved 2014).

O. ASTM C1314 - Standard Test Method for Compressive Strength of Masonry Prisms; 2016.

P. ASTM E514/E514M - Standard Test Method for Water Penetration and Leakage Through Masonry; 2014a.

Q. BIA Technical Notes No. 7 - Water Penetration Resistance – Design and Detailing; 2005.

R. BIA Technical Notes No. 28B - Brick Veneer/Steel Stud Walls; 2005.

S. BIA Technical Notes No. 46 - Maintenance of Brick Masonry; 2005.

T. UL (FRD) - Fire Resistance Directory; current edition.

1.06 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all relevant installers.

1.07 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.

C. Samples: Submit four samples of facing brick units to illustrate color, texture, and extremes of color range.

D. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

E. LEED Product and Material Data Summary Form: For all installed products and materials of this Section, complete the “LEED Product and Material Data Summary Form” (attached to end of Section 01 81 13 - Sustainable Design Requirements)

1. Product Material Cost: Provide the cost for material, or an assembled product, including taxes and delivery but excluding any cost for labor and equipment required for installation after the material is delivered to the site.
2. Product Data for Credit MRc4, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer

recycled content. Include statement indicating cost for each product having recycled content.

3. Product Data for Credit MRc5, Regional Material: For products having regional materials, documentation indicating location of raw material extraction, harvest or recovery, as well as, manufacture (location of final assembly) within 500 miles of project site. Include statement indicating cost for each material or component of the assembled product.

1.08 QUALITY ASSURANCE

A. Comply with provisions of TMS 402/602, except where exceeded by requirements of the contract documents.

B. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section with minimum three years of documented experience.

C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

D. Sustainability and LEED Standards Certification:
   1. Regional manufactured products with percentage by weight.
   2. Recycled content calculated as 1/2 preconsumer + postconsumer.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS

A. Concrete Block: Comply with referenced standards and as follows:
   1. Size: Standard units with nominal face dimensions of 16 by 8 inches and nominal depths as indicated on the drawings for specific locations.
   2. Special Shapes: Provide non-standard blocks configured for corners, lintels, control joint edges, and other detailed conditions.
   3. Load-Bearing and Non-Loadbearing Units: ASTM C90, normal weight.
      a. Hollow block, as indicated.
      b. Exposed Faces: Manufacturer's standard color and texture.

2.02 BRICK UNITS

A. Facing Brick: ASTM C216, Type FBX, Grade SW.
   1. Color and texture: Match existing.
   2. Nominal size: Match existing unit size.
   3. Special shapes: Molded units as required by conditions indicated, unless standard units can be sawn to produce equivalent effect.

2.03 MORTAR AND GROUT MATERIALS

A. Mortar and Grout: As specified in Section 04 05 11.

B. Masonry Cement: NOT PERMITTED.

C. Portland Cement: ASTM C150/C150M, Type I; color as required to produce approved color sample.

D. Hydrated Lime: ASTM C207, Type S.

E. Mortar Aggregate: ASTM C144.

F. Grout Aggregate: ASTM C404.

G. Water: Clean and potable.

H. Accelerating Admixture: Nonchloride type for use in cold weather.

I. Integral Water Repellent Admixture for Mortar: Polymeric liquid admixture added to mortar at the time of manufacture.
   1. Use only in combination with masonry units manufactured with integral water repellent admixture.
   2. Use only water repellent admixture for mortar from the same manufacturer as water repellent admixture in masonry units.
   3. Meet or exceed performance specified for water repellent admixture used in masonry units.

2.04 REINFORCEMENT AND ANCHORAGE

A. Manufacturers:
   1. Blok-Lok Limited: www.blok-lok.com.
   2. Hohmann & Barnard, Inc; 2-Seal Tie: www.h-b.com/sle.
   3. WIRE-BOND: www.wirebond.com.

B. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi), deformed billet bars; uncoated.

C. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.

D. Single Wythe Joint Reinforcement: Truss or ladder type; ASTM A1064/A1064M steel wire, mill galvanized to ASTM A641/A641M, Class 3; 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage on each exposure.

E. Multiple Wythe Joint Reinforcement: Truss type; fabricated with moisture drip; ASTM A1064/A1064M steel wire, hot dip galvanized after fabrication to ASTM A153/153M, Class B; 0.1483 inch side rods with 0.1483 inch cross rods; width as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage on each exposure.

F. Adjustable Multiple Wythe Joint Reinforcement: Truss type with adjustable ties spaced at 16 in on center ASTM A1064/A1064M steel wire, hot dip galvanized after fabrication to ASTM A153/153M, Class B; 0.1875 inch side rods with 0.1483 inch cross rods and adjustable components of 0.1875 inch wire; width of components as required to provide not more than 1 inch and not less than 1/2 inch of mortar coverage from each masonry face.
   1. Vertical adjustment: Not less than 3-1/2 inches.

G. Two-Piece Wall Ties: Formed steel wire, 0.1875 inch thick, adjustable, eye and pintle type, hot dip galvanized to ASTM A 153/A 153M, Class B, sized to provide not more than 1 inch and not less than 1/2 inch of mortar coverage from masonry face and to allow vertical adjustment of up to 1-1/4 in.

H. Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural backup, stainless steel.
   1. Anchor plates: Not less than.093 inch thick, designed for fastening to structural backup through sheathing by two fasteners.

2. Pintles: Trapezoidal, or rectangular shape, 0.1875 inch thick.
3. Vertical adjustment: Not less than 2 inches.
4. Manufacturers:
   a. HB-200-X anchor by Hohmann & Barnard, Inc. (www.h-b.com)

I. Metal-to-Metal Fasteners: Self-drilling, self-tapping screws; corrosion resistant finish or hot dip galvanized to ASTM A153/A153M.

2.05 FLASHINGS

A. See Section 07 62 00 - Sheet Metal Flashing and Trim

2.06 ACCESSORIES

A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.

B. Joint Filler: Closed cell polyvinyl chloride; oversized 50 percent to joint width; self expanding.

C. Cavity Mortar Control: Semi-rigid polyethylene or polyester mesh panels, sized to thickness of wall cavity, and designed to prevent mortar droppings from clogging weeps and cavity vents and allow proper cavity drainage.
   1. Mortar Diverter: Semi-rigid mesh designed for installation at flashing locations.
      a. Manufacturers:
         1) Mortar Net Solutions; Mortar Net with Insect Barrier; www.mortarnet.com.
      b. Locations: At flashing locations in brick veneer walls.

D. Termination Bars: Stainless steel; compatible with membrane and adhesives.

E. Lap Sealants and Tapes: As recommended by flashing manufacturer; compatible with membrane and adhesives.

F. Weeps & Cavity Vents:
   1. Type: Polyester mesh.
   2. Manufacturers:
      a. CavClear/Archovations, Inc: www.cavclear.com.
      b. Mortar Net Solutions; www.mortarnet.com.
      c. Colors: selected from manufacturers standard range..

G. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry.

B. Verify that related items provided under other sections are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.02 PREPARATION

A. Direct and coordinate placement of metal anchors supplied for installation under other sections.

B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.03 COLD AND HOT WEATHER REQUIREMENTS

A. Maintain materials and surrounding air temperature to minimum 40 degrees F prior to, during, and 48 hours after completion of masonry work.

B. Maintain materials and surrounding air temperature to maximum 90 degrees F prior to, during, and 48 hours after completion of masonry work.

3.04 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Concrete Masonry Units:
   1. Bond: Running.
   2. Coursing: One unit and one mortar joint to equal 8 inches.
   3. Mortar Joints: Concave.

D. Brick Units:
   1. Bond: Running.
   2. Coursing: Three units and three mortar joints to equal 8 inches.
   3. Mortar Joints: Concave.

3.05 PLACING AND BONDING

A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

B. Lay hollow masonry units with face shell bedding on head and bed joints.

C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.

D. Remove excess mortar and mortar smears as work progresses.

E. Remove excess mortar with water repellent admixture promptly. Do not use acids, sandblasting or high pressure cleaning methods.

F. Interlock intersections and external corners.

G. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

H. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

I. Cut mortar joints flush where wall tile is scheduled or resilient base is scheduled.

J. Isolate masonry partitions from vertical structural framing members with a control joint as indicated.

K. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

3.06 WEEPS/CAVITY VENTS

A. Install weeps in veneer and cavity walls at 24 inches on center horizontally above through-wall flashing, above shelf angles and lintels, and at bottom of walls.

B. Place weeps directly on flashing.

C. Do not strike mortar across bottom of weep. If mortar is struck across weep, remove and replace weep.

D. Install cavity vents in veneer and cavity walls at 24 inches on center horizontally below shelf angles and lintels and near top of walls.

3.07 CAVITY MORTAR CONTROL

A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.

B. Install cavity mortar diverter at base of cavity and at other flashing locations as recommended by manufacturer to prevent mortar droppings from blocking weep/cavity vents.

3.08 REINFORCEMENT AND ANCHORAGE - SINGLE WYTHE MASONRY

A. Install horizontal joint reinforcement 16 inches on center.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.

C. Place continuous joint reinforcement in first and second joint below top of walls.

D. Lap joint reinforcement ends minimum 6 inches.

3.09 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER

A. Masonry Back-Up: Embed anchors to bond veneer at maximum 16 inches on center vertically and 16 inches on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.

B. Stud Back-Up: Secure veneer anchors to stud framed back-up and embed into masonry veneer at maximum 16 inches on center vertically and 16 inches on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.

3.10 REINFORCEMENT AND ANCHORAGES - MULTIPLE WYTHE UNIT MASONRY

A. Install horizontal joint reinforcement 16 inches on center.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.

C. Place continuous joint reinforcement in first and second joint below top of walls.

D. Lap joint reinforcement ends minimum 6 inches.

E. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.

3.11 MASONRY FLASHINGS

A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
   1. Extend flashings full width at such interruptions and at least 6 inches, minimum, into adjacent masonry or turn up at least 8 inches, minimum, to form watertight pan at non-masonry construction.
   2. Remove or cover protrusions or sharp edges that could puncture flashings.
   3. Seal lapped ends and penetrations of flashing before covering with mortar.

B. Extend metal flashings through exterior face of masonry. Install flashing in two beads of butyl joint sealer Type 3 below flashing to prevent moisture migration under flashing. Refer to Section 07 92 00 - Joint Sealants.

C. Lap end joints of flashings at least 6 inches, minimum, and seal watertight with sealant type 3. Refer to Section 07 62 00 - Sheet Metal Flashing and Trim and 07 92 00 - Joint Sealants

3.12 LINTELS

A. Install loose steel lintels over new openings at exterior walls.

B. Install precast concrete lintels over new openings at interior masonry walls.

C. Maintain minimum 6 to 8 inch bearing on each side of opening.

3.13 GROUTED COMPONENTS

A. Reinforce bond beams as noted on the Contract Drawings.

B. Lap splices minimum 24 bar diameters.

C. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.

D. Place and consolidate grout fill without displacing reinforcing.

E. At bearing locations, fill masonry cores with grout for a minimum 12 inches either side of opening.

3.14 CONTROL AND EXPANSION JOINTS

A. Do not continue horizontal joint reinforcement through control or expansion joints.

B. Form control joint with a sheet building paper bond breaker fitted to one side of the hollow contour end of the block unit. Fill the resultant core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant.

C. Size control joints as indicated on drawings; if not indicated, 3/8 inch wide and deep.

D. Form expansion joint as detailed on drawings.

3.15 BUILT-IN WORK

A. As work progresses, install built-in metal door frames, window frames, anchor bolts, and plates and other items to be built into the work and furnished under other sections.

B. Install built-in items plumb, level, and true to line.

C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.

1. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.

D. Do not build into masonry construction organic materials that are subject to deterioration.

3.16 TOLERANCES

A. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.

B. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.

C. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

D. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.

3.17 CUTTING AND FITTING

A. Cut and fit for chases, pipes, conduit, sleeves, grounds, and other items. Coordinate with other sections of work to provide correct size, shape, and location.

B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.18 CLEANING

A. Remove excess mortar and mortar droppings.

B. Replace defective mortar. Match adjacent work.

C. Clean soiled surfaces with cleaning solution.

D. Use non-metallic tools in cleaning operations.

3.19 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION

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SECTION 04 72 00
CAST STONE MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Architectural cast stone.

B. Units required are:
   1. Exterior wall units, including wall caps and sills.
   2. Flooring and paving units, including stair treads.
   3. Other items indicated on the drawings.

1.02 RELATED REQUIREMENTS

A. Section 01 74 19 – Construction Waste Management.

B. Section 01 81 13 – Sustainable Design Requirements.

C. Section 04 20 00 - Unit Masonry: Installation of cast stone in conjunction with masonry.

D. Section 07 92 00 - Joint Sealants: Sealing joints indicated to be left open for sealant.

E. Section 32 33 00 - Site Furnishings: Precast concrete, wood or metal benches; precast concrete or metal bollards.

1.03 LEED REQUIREMENTS

A. LEED Focus Materials (LFMs) For This Section
   1. Targeted products containing Recycled Content (MRc4)
   2. Targeted products containing Regional Material (MRc5)

1.04 REFERENCE STANDARDS

A. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2014 (Errata 2016).

B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

C. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2016.

D. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement; 2009 (Reapproved 2015).

E. ASTM A884/A884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement; 2014.

F. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2017.

G. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2016.

H. ASTM C150/C150M - Standard Specification for Portland Cement; 2016.

I. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2014a.

J. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2016.

K. ASTM C1364 - Standard Specification for Architectural Cast Stone; 2017.

1.05 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Product Data: Test results of cast stone components made previously by the manufacturer.

C. Shop Drawings: Include elevations, dimensions, layouts, profiles, cross sections, reinforcement, exposed faces, arrangement of joints, anchoring methods, anchors, and piece numbers.

D. Mortar Color Selection Samples.

E. Verification Samples: Pieces of actual cast stone components not less than 6 inches square, illustrating range of color and texture to be anticipated in components furnished for the project.

F. Source Quality Control Test Reports.

G. Manufacturer's Qualification Data: Documentation showing compliance with specified requirements.

H. LEED Product and Material Data Summary Form: For all installed products and materials of this Section, complete the "LEED Product and Material Data Summary Form" (attached to end of Section 01 81 13 - Sustainable Design Requirements)

1. Product Material Cost: Provide the cost for material, or an assembled product, including taxes and delivery but excluding any cost for labor and equipment required for installation after the material is delivered to the site.
2. Product Data for Credit MRc4, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating cost for each product having recycled content.
3. Product Data for Credit MRc5, Regional Material: For products having regional materials, documentation indicating location of raw material extraction, harvest or recovery, as well as, manufacture (location of final assembly) within 500 miles of project site. Include statement indicating cost for each material or component of the assembled product.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. A firm with a minimum of 5 years experience producing cast stone of types required for project.
2. Current producer member of the Cast Stone Institute or the Architectural Precast Association.
3. Adequate plant capacity to furnish quality, sizes, and quantity of cast stone required without delaying progress of the work.

B. Sustainability and LEED Standards Certification:

1. Regional manufactured products with percentage by weight.
2. Recycled content calculated as 1/2 preconsumer + postconsumer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver cast stone components secured to shipping pallets and protected from damage and discoloration. Protect corners from damage.

B. Number each piece individually to match shop drawings and schedule.

C. Store cast stone components and installation materials in accordance with manufacturer's instructions.

D. Store cast stone components on pallets with nonstaining, waterproof covers. Ventilate under covers to prevent condensation. Prevent contact with dirt.

E. Protect cast stone components during handling and installation to prevent chipping, cracking, or other damage.

F. Store mortar materials where contamination can be avoided.

G. Schedule and coordinate production and delivery of cast stone components with unit masonry work to optimize on-site inventory and to avoid delaying the work.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Architectural Cast Stone:
   1. Any current producer member of the Architectural Precast Association.
   2. Any current producer member of the Cast Stone Institute.

2.02 ARCHITECTURAL CAST STONE

A. Cast Stone: Architectural concrete product manufactured to simulate appearance of natural limestone, complying with ASTM C1364.
   1. Compressive Strength: As specified in ASTM C1364; calculate strength of pieces to be field cut at 80 percent of uncut piece.
   2. Freeze-Thaw Resistance: Demonstrated by laboratory testing in accordance with ASTM C1364.
   3. Surface Texture: Fine grained texture, with no bugholes, air voids, or other surface blemishes visible from distance of 20 feet.
   4. Remove cement film from exposed surfaces before packaging for shipment.

B. Shapes: Provide shapes indicated on drawings.
   1. Variation from Any Dimension, Including Bow, Camber, and Twist: Maximum of plus/minus 1/8 inch or length divided by 360, whichever is greater, but not more than 1/4 inch.
   2. Unless otherwise indicated on drawings, provide:
      a. Wash or slope of 1:12 on exterior horizontal surfaces.
      b. Drips on projecting components, wherever possible.
      c. Raised fillets at back of sills and at ends to be built in.

C. Reinforcement: Provide reinforcement as required to withstand handling and structural stresses; comply with ACI 318.

2.03 MATERIALS

A. Portland Cement: ASTM C150/C150M.
   1. For Mortar: Type I or II, except Type III may be used in cold weather.

B. Coarse Aggregate: ASTM C33/C33M, except for gradation; granite, quartz, or limestone.

C. Fine Aggregate: ASTM C33/C33M, except for gradation; natural or manufactured sands.

D. Admixtures: ASTM C494/C494M.

E. Water: Potable.

F. Reinforcing Bars: ASTM A615/A615M deformed bars, galvanized.
   1. Galvanized in accordance with ASTM A767/A767M, Class I.

G. Steel Welded Wire Reinforcement: ASTM A1064/A1064M, galvanized or ASTM A884/A884M, epoxy coated.

H. Embedded Anchors, Dowels, and Inserts: Type 304 stainless steel, of type and size as required for conditions.

I. Shelf Angles and Similar Structural Items: Hot-dip galvanized steel per ASTM A123/A123M, of shapes and sizes as required for conditions.

J. Mortar: Portland cement-lime, ASTM C270, Type N; do not use masonry cement.

K. Cleaner: General-purpose cleaner designed for removing mortar and grout stains, efflorescence, and other construction stains from new masonry surfaces without discoloring or damaging masonry surfaces; approved for intended use by cast stone manufacturer and by cleaner manufacturer for use on cast stone and adjacent masonry materials.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine construction to receive cast stone components. Notify Architect if construction is not acceptable.

B. Do not begin installation until unacceptable conditions have been corrected.

3.02 INSTALLATION

A. Install cast stone components in conjunction with masonry, complying with requirements of Section 04 20 00.

B. Mechanically anchor cast stone units indicated; set remainder in mortar.

C. Setting:
   1. Drench cast stone components with clear, running water immediately before installation.
   2. Set units in a full bed of mortar unless otherwise indicated.
   3. Fill vertical joints with mortar.
   4. Fill dowel holes and anchor slots completely with mortar or non-shrink grout.

D. Joints: Make all joints 3/8 inch, except as otherwise detailed.
   1. Rake mortar joints 3/4 inch for pointing.
   2. Remove excess mortar from face of stone before pointing joints.
   3. Point joints with mortar in layers 3/8 inch thick and tool to a slight concave profile.
   4. Leave the following joints open for sealant:
      a. Head joints in top courses, including copings, parapets, cornices, sills, and steps.
      b. Joints in projecting units.
      c. Joints between rigidly anchored units, including soffits, panels, and column covers.
      d. Joints below lugged sills and stair treads.
      e. Joints below ledge and relieving angles.
      f. Joints labeled "expansion joint".
   5. Provide sealants in all cast stone joints (new and existing).

E. Repairs: Repair chips and other surface damage noticeable when viewed in direct daylight at 20 feet.
   1. Repair with matching touchup material provided by the manufacturer and in accordance with manufacturer's instructions.

2. Repair methods and results subject to Architect 's approval.

3.03 CLEANING

A. Keep cast stone components clean as work progresses.

3.04 PROTECTION

A. Protect completed work from damage.

B. Clean, repair, or restore damaged or mortar-splashed work to condition of new work.

END OF SECTION

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SECTION 05 12 00
STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Structural steel framing members.

B. Structural steel support members and base plates.

C. Grouting under base plates.

1.02 RELATED REQUIREMENTS

A. Section 01 74 19 – Construction Waste Management.

B. Section 01 81 13 – Sustainable Design Requirements.

C. Section 05 31 00 - Steel Decking: Support framing for small openings in deck.

D. Section 05 50 00 - Metal Fabrications: Steel fabrications affecting structural steel work.

1.03 LEED REQUIREMENTS

A. LEED Focus Materials (LFMs) For This Section
   1. Targeted products containing Recycled Content (MRc4)
   2. Targeted products containing Regional Material (MRc5)

1.04 REFERENCE STANDARDS

A. AISC (MAN) - Steel Construction Manual; 2011.

B. AISC 303 - Code of Standard Practice for Steel Buildings and Bridges; 2016.

C. AISC S303 - Code of Standard Practice for Steel Buildings and Bridges; 2016.

D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

E. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2013.

F. ASTM A529/A529M - Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality; 2014.

G. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts; 2015.

H. ASTM A563M - Standard Specification for Carbon and Alloy Steel Nuts (Metric); 2007 (Reapproved 2013).

I. ASTM A992/A992M - Standard Specification for Structural Steel Shapes; 2011 (Reapproved 2015).

J. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions; 2015a.

K. ASTM F436/F436M - Standard Specification for Hardened Steel Washers Inch and Metric Dimensions; 2016.

L. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength; 2015.

M. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.

N. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015 (with March 2016 Errata).

O. RCSC (HSBOLT) - Specification for Structural Joints Using High-Strength Bolts; Research Council on Structural Connections; 2014, with April 2015 Errata.

1.05 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Shop Drawings:
   1. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, and fasteners.
   2. Connections not detailed.
   3. Indicate loads.
   4. Indicate welded connections with AWS A2.4 welding symbols. Indicate net weld lengths.

C. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within the previous 12 months.

D. LEED Product and Material Data Summary Form: For all installed products and materials of this Section, complete the “LEED Product and Material Data Summary Form” (attached to end of Section 01 81 13 - Sustainable Design Requirements)
   1. Product Material Cost: Provide the cost for material, or an assembled product, including taxes and delivery but excluding any cost for labor and equipment required for installation after the material is delivered to the site.
   2. Product Data for Credit MRc4, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating cost for each product having recycled content.
   3. Product Data for Credit MRc5, Regional Material: For products having regional materials, documentation indicating location of raw material extraction, harvest or recovery, as well as, manufacture (location of final assembly) within 500 miles of project site. Include statement indicating cost for each material or component of the assembled product.

1.06 QUALITY ASSURANCE

A. Fabricate structural steel members in accordance with AISC (MAN) "Steel Construction Manual."

B. Sustainability and LEED Standards Certification:
   1. Regional manufactured products with percentage by weight.
   2. Recycled content calculated as 1/2 preconsumer + postconsumer.

PART 2 PRODUCTS

2.01 MATERIALS

A. Steel Angles, Plates, and Channels: ASTM A36/A36M.

B. Steel W Shapes and Tees: ASTM A992/A992M.

C. Rolled Steel Structural Shapes: ASTM A992/A992M.

D. Steel Shapes, Plates, and Bars: ASTM A529/A529M high-strength, carbon-manganese structural steel, Grade 50.

E. Cold-Formed Structural Tubing: ASTM A500/A500M, Grade B.

F. High-Strength Structural Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, with matching compatible ASTM A563 or ASTM A563M nuts and ASTM F436/F436M washers.

G. Headed Anchor Rods: ASTM F1554, Grade 36, plain.

H. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

I. Grout: ASTM C1107/C1107M; Non-shrink; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
   1. Minimum Compressive Strength at 28 Days: 7,000 pounds per square inch.

J. Shop and Touch-Up Primer: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.

K. Touch-Up Primer for Galvanized Surfaces: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.

2.02 FABRICATION

A. Shop fabricate to greatest extent possible.

B. Continuously seal joined members by continuous welds. Grind exposed welds smooth.

C. Fabricate connections for bolt, nut, and washer connectors.

2.03 FINISH

A. Shop prime structural steel members. Do not prime surfaces that will be fireproofed, field welded, in contact with concrete, or high strength bolted.

PART 3 EXECUTION

3.01 ERECTION

A. Erect structural steel in compliance with AISC 303.

B. Field weld components indicated on shop drawings.

C. Use carbon steel bolts only for temporary bracing during construction, unless otherwise specifically permitted on drawings. Install high-strength bolts in accordance with RCSC (HSBOLT) "Specification for Structural Joints Using High-Strength Bolts".

D. Do not field cut or alter structural members without approval of Architect.

E. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

F. Grout solidly between column plates and bearing surfaces, complying with manufacturer's instructions for nonshrink grout. Trowel grouted surfaces smooth, splaying neatly to 45 degrees.

3.02 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

3.03 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.

END OF SECTION

SECTION 05 40 00
COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Formed steel stud exterior wall framing.

B. Exterior wall sheathing.

1.02 RELATED REQUIREMENTS

A. Section 01 74 19 – Construction Waste Management.

B. Section 01 81 13 – Sustainable Design Requirements.

1.03 LEED REQUIREMENTS

A. LEED Focus Materials (LFMs) For This Section
   1. Targeted products containing Recycled Content (MRc4)
   2. Targeted products containing Regional Material (MRc5)

1.04 REFERENCE STANDARDS

A. AISI S100-12 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2012.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

D. ASTM C955 - Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases; 2015.

E. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2011a (Reapproved 2015).

F. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2013.

G. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

1.05 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Product Data: Provide data on standard framing members; describe materials and finish, product criteria, limitations.

C. Product Data: Provide manufacturer's data on factory-made framing connectors, showing compliance with requirements.

D. Manufacturer's Installation Instructions: Indicate special procedures, conditions requiring special attention.

E. LEED Product and Material Data Summary Form: For all installed products and materials of this Section, complete the “LEED Product and Material Data Summary Form” (attached to end of Section 01 81 13 - Sustainable Design Requirements)
   1. Product Material Cost: Provide the cost for material, or an assembled product, including taxes and delivery but excluding any cost for labor and equipment required for installation after the material is delivered to the site.
   2. Product Data for Credit MRc4, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating cost for each product having recycled content.
   3. Product Data for Credit MRc5, Regional Material: For products having regional materials, documentation indicating location of raw material extraction, harvest or recovery, as well as, manufacture (location of final assembly) within 500 miles of project site. Include statement indicating cost for each material or component of the assembled product.

1.06 QUALITY ASSURANCE

A. Sustainability and LEED Standards Certification:
   1. Regional manufactured products with percentage by weight.
   2. Recycled content calculated as 1/2 preconsumer + postconsumer.

PART 2 PRODUCTS

2.01 FRAMING SYSTEM

A. Provide primary and secondary framing members, bridging, bracing, plates, gussets, clips, fittings, reinforcement, and fastenings as required to provide a complete framing system.

2.02 FRAMING MATERIALS

A. Studs and Track: ASTM C955; studs formed to channel, "C", or "Sigma" shape with punched web; U-shaped track in matching nominal width and compatible height.
   1. Gage and Depth: As indicated on the drawings.
   2. Galvanized in accordance with ASTM A653/A653M, G90/Z275 coating.

B. Framing Connectors: Factory-made, formed steel sheet.
   1. Material: ASTM A653/A653M SS Grade 33 (minimum), with G60/Z180 hot dipped galvanized coating for base metal thickness less than 10 gage, 0.1345 inch, and factory punched holes and slots.
   2. Structural Performance: Maintain load and movement capacity required by applicable code, when evaluated in accordance with AISI S100-12.
   3. Movement Connections: Provide mechanical anchorage devices that accommodate movement using slotted holes, shouldered screws or screws and anti-friction or stepped bushings, while maintaining structural performance of framing. Provide movement connections where indicated on drawings.
      a. Where top of stud wall terminates below structural floor or roof, connect studs to structure in manner allowing vertical movement of slab without affecting studs; allow for minimum movement of 1/2 inch.
   4. Fixed Connections: Provide non-movement connections for tie-down to foundation, floor-to-floor tie-down, roof-to-wall tie-down, joist hangers, gusset plates, and stiffeners.

2.03 WALL SHEATHING

A. Glass mat faced gypsum board; ASTM C1177/C1177M, square long edges, 5/8 inch thick, Type X - Fire Resistant.

2.04 FASTENERS

A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot dip galvanized per ASTM A153/A153M.

B. Anchorage Devices: Powder actuated.

PART 3 EXECUTION

3.01 INSTALLATION OF STUDS

A. Install components in accordance with manufacturers' instructions and ASTM C1007 requirements.

B. Align floor and ceiling tracks; locate to wall layout. Secure in place with fasteners at maximum 24 inches on center. Coordinate installation of sealant with floor and ceiling tracks.

C. Place studs at 16 inches on center; not more than 2 inches from abutting walls and at each side of openings. Connect studs to tracks using fastener method.

D. Construct corners using minimum of three studs. Install double studs at wall openings, door and window jambs.

E. Install intermediate studs above and below openings to align with wall stud spacing.

F. Provide deflection allowance in stud track, directly below horizontal building framing at non-load bearing framing.

3.02 INSTALLATION OF WALL SHEATHING

A. Install wall sheathing with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using self-tapping screws.

1. Provide steel diagonal bracing at corners with foam insulation or gypsum board wall sheathing.

END OF SECTION

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SECTION 05 50 00
METAL FABRICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Shop fabricated metal items as scheduled herein.

B. Prefabricated ladders and ship ladders.

1.02 RELATED REQUIREMENTS

A. Section 01 74 19 – Construction Waste Management.

B. Section 01 81 13 – Sustainable Design Requirements.

C. Section 03 30 00 - Cast-in-Place Concrete: Placement of metal fabrications in concrete.

D. Section 04 20 00 - Unit Masonry: Placement of metal fabrications in masonry.

E. Section 05 12 00 - Structural Steel Framing: Structural steel column anchor bolts and related work.

F. Section 05 51 00 - Metal Stairs.

G. Section 05 52 13 - Pipe and Tube Railings.

H. Section 09 90 00 - Paints and Coatings

1.03 LEED REQUIREMENTS

A. LEED Focus Materials (LFMs) For This Section
   1. Targeted products containing Recycled Content (MRc4)
   2. Targeted products containing Regional Material (MRc5)

1.04 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).

B. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements; 2008.

C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

D. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

E. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

F. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

G. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2013.

H. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2014.

I. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2013.

J. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

K. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.

L. ASTM B210 - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes; 2012.

M. ASTM B210M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes (Metric); 2012.

N. ASTM B211M - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold-Finished Bar, Rod, and Wire (Metric); 2012.

O. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

P. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.

Q. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions; 2015a.

R. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.

S. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015 (with March 2016 Errata).

T. AWS D1.2/D1.2M - Structural Welding Code - Aluminum; 2008.

U. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 1999 (Ed. 2004).

V. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).

W. SSPC-SP 2 - Hand Tool Cleaning; 1982 (Ed. 2004).

1.05 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

C. Welders' Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.

D. LEED Product and Material Data Summary Form: For all installed products and materials of this Section, complete the “LEED Product and Material Data Summary Form” (attached to end of Section 01 81 13 - Sustainable Design Requirements)
   1. Product Material Cost: Provide the cost for material, or an assembled product, including taxes and delivery but excluding any cost for labor and equipment required for installation after the material is delivered to the site.
   2. Product Data for Credit MRc4, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating cost for each product having recycled content.

3. Product Data for Credit MRc5, Regional Material: For products having regional materials, documentation indicating location of raw material extraction, harvest or recovery, as well as, manufacture (location of final assembly) within 500 miles of project site. Include statement indicating cost for each material or component of the assembled product.

1.06 QUALITY ASSURANCE

A. Design fabricated items under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State in which the Project is located.

B. Sustainability and LEED Standards Certification:
   1. Regional manufactured products with percentage by weight.
   2. Recycled content calculated as 1/2 preconsumer + postconsumer.

PART 2 PRODUCTS

2.01 MATERIALS - STEEL

A. Steel Sections: ASTM A36/A36M.

B. Steel Tubing: ASTM A500/A500M, Grade B cold-formed structural tubing.

C. Plates: ASTM A283/A283M.

D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.

E. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, plain.

F. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

G. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

H. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.02 MATERIALS - ALUMINUM

A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.

B. Sheet Aluminum: ASTM B209 (ASTM B209M), 5052 alloy, H32 or H22 temper.

C. Aluminum-Alloy Drawn Seamless Tubes: ASTM B210 (ASTM B210M), 6063 alloy, T6 temper.

D. Bolts, Nuts, and Washers: Stainless steel.

E. Welding Materials: AWS D1.2/D1.2M; type required for materials being welded.

2.03 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Continuously seal joined members by continuous welds.

D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.04 FABRICATED ITEMS

A. Supply and install metal fabrications listed below complete with anchorage and attachments necessary for installation.

B. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of metal decking and masonry; galvanized finish.

C. Steel lintels:
   1. Provide hot dip galvanized loose steel lintels in masonry. Lintels shall be provided for all exterior masonry veneer openings and as showin on the drawings. Bear lintels 8" on masonry at each jamb.
   2. Refer to structural drawings for sizes.

D. Key Angle:
   1. Where new masonry walls intersect existing and where shown on the drawings, provide continuous steel angle for construction joints. Expansion bolt angle to masonry walls.

E. Elevator shaft hoist beam: Size per structural drawings.

F. Elevator sill angles:
   1. Provide 5" x 5" x 5/16" sill angles at each elevator entrance.
   2. Secure to floor structure and fill with grout as directed on the elevator shop drawings.

G. Elevator pit ladder: Provide elevator pit ladder where shown on the drawings.
   1. Ladder shall extend a min. of 4'-0" above finished floor.
   2. Provide 2-1/2" x 1/2" continuous structural steel flat bars with eased edges, spaced 1'-6" apart.
   3. Rungs shall be 1" square solid rungs with non-slip surface on top of each rung.
      a. Coat rung with aluminum oxide granules set in epoxy resin or use a type of manufactured rung which is filled with aluminum oxide grout.
      b. Fit rungs in centerline of side rails, plug weld and grind smooth on outer face of rail.
   4. Support ladder at top and bottom.
      a. Use brackets designed for adequate support and anchorage; weld to rails.
      b. Hold ladder min. 7" clear of wall to centerline of rungs.

H. Dunnage for roof top equipment: Provide as shown on the drawings.

I. Roof curb covers: Provide 16 gauge galvanized sheet metal tops as sized and details on the drawings.

J. Roof Screen Frame:
   1. Furnish roof screen tubular steel structural frame at equipment screens.
   2. All steel shall be A36 hot dipped galvanized.
   3. Refer to specification Section 07 62 00 - Sheet Metal Flashing and Trim

2.05 PREFABRICATED LADDERS

A. Prefabricated Ladder: Welded metal unit complying with ANSI A14.3; factory fabricated to greatest degree practical and in the largest components possible.
   1. Components: Manufacturer's standard rails, rungs, treads, handrails. returns, platforms and safety devices complying with the requirements of the MATERIALS article of this section.

2. Materials: Aluminum; ASTM B221 (ASTM B221M), 6063 alloy, T52 temper.
3. Finish: Manufacturer's standard clear anodized coating, comply with AAMA 611, Class 1.
4. Manufacturers:
   a. O'Keeffe's Inc: Model 503A: www.okeeffes.com/sle.
   b. Substitutions: See Section 01 60 00 - Product Requirements.

2.06 DOWNSPOUT BOOTS

A. Downspout Boots: Smooth interior without boxed corners or choke points; include integral lug slots, integral cleanout, cleanout cover, and tamper proof fasteners.
   1. Configuration: Offset.
   2. Material: Cast iron; ASTM A48/A48M; casting thickness 3/8 inch (9.5 mm), minimum.
   3. Finish: Manufacturer's standard factory applied powder coat finish.
   4. Color: To be selected by Architect from manufacturer's standard range.
   5. Manufacturers:
      a. Downspoutboots.com, a division of J. R. Hoe & Sons: www.downspoutboots.com.
      b. Neenah Foundry, a division of Neenah Enterprises, Inc: www.nfco.com.

2.07 FINISHES - STEEL

A. Prime paint steel items.
   1. Exceptions: Galvanize items to be embedded in concrete and items to be embedded in masonry.
   2. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.

B. Prepare surfaces to be primed in accordance with SSPC-SP2.

C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

D. Prime Painting: Two coats.

E. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements. Provide minimum 1.7 oz/sq ft galvanized coating.

F. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

2.08 FABRICATION TOLERANCES

A. Squareness: 1/8 inch maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch.

C. Maximum Misalignment of Adjacent Members: 1/16 inch.

D. Maximum Bow: 1/8 inch in 48 inches.

E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Field weld components as indicated on drawings.

D. Perform field welding in accordance with AWS D1.1/D1.1M.

E. Obtain approval prior to site cutting or making adjustments not scheduled.

F. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

SECTION 05 51 00
METAL STAIRS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior exit stair 4

B. Stairs with concrete treads.

C. Structural steel stair framing and supports.

D. Handrails and guards.

E. Prefabricated stair treads and nosings.

1.02 RELATED REQUIREMENTS

A. Section 01 74 19 – Construction Waste Management.

B. Section 01 81 13 – Sustainable Design Requirements.

C. Section 01 81 19 – Indoor Air Quality Requirements.

D. Section 03 30 00 - Cast-in-Place Concrete: Concrete fill in stair pans; mesh reinforcement for landings.

E. Section 04 20 00 - Unit Masonry: Placement of metal fabrications in masonry.

F. Section 05 50 00 - Metal Fabrications.

G. Section 05 52 13 - Pipe and Tube Railings: Metal handrails for the stairs specified in this section.

H. Section 09 90 00 - Paints and Coatings

1.03 LEED REQUIREMENTS

A. LEED Focus Materials (LFMs) For This Section
   1. Targeted products containing Recycled Content (MRc4)
   2. Targeted products containing Regional Material (MRc5)

1.04 REFERENCE STANDARDS

A. AISC 201 - AISC Certification Program for Structural Steel Fabricators, Standard for Steel Building Structures; 2006.

B. ASTM A6/A6M - Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling; 2017.

C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

D. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

E. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

F. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

G. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2013.

H. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2013.

I. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2014.

J. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

K. ASTM A786/A786M - Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates; 2015.

L. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2016.

M. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2015.

N. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings; 2013, with Editorial Revision.

O. ASTM E985 - Standard Specification for Permanent Metal Railing Systems and Rails for Buildings; 2000 (Reapproved 2006).

P. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions; 2015a.

Q. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.

R. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015 (with March 2016 Errata).

S. NAAMM AMP 510 - Metal Stairs Manual; 1992, Fifth Edition.

T. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 1999 (Ed. 2004).

U. SSPC-SP 2 - Hand Tool Cleaning; 1982 (Ed. 2004).

1.05 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
   2. Include the design engineer's stamp or seal on each sheet of shop drawings.

C. Welders' Certificates.

D. LEED Product and Material Data Summary Form: For all installed products and materials of this Section, complete the “LEED Product and Material Data Summary Form” (attached to end of Section 01 81 13 - Sustainable Design Requirements)
   1. Product Material Cost: Provide the cost for material, or an assembled product, including taxes and delivery but excluding any cost for labor and equipment required for installation after the material is delivered to the site.
   2. Product Data for Credit MRc4, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer

recycled content. Include statement indicating cost for each product having recycled content.

3. Product Data for Credit MRc5, Regional Material: For products having regional materials, documentation indicating location of raw material extraction, harvest or recovery, as well as, manufacture (location of final assembly) within 500 miles of project site. Include statement indicating cost for each material or component of the assembled product.

1.06 QUALITY ASSURANCE

A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located, or personnel under direct supervision of such an engineer.

B. Drawing review: Structural Engineer of Record will review shop drawings for conformance with the contract documents and the loads specified. Corrections to the shop drawings required by Engineer's review shall not constitute a change in contract amount for pricing and detailing.

C. Welder Qualifications: Show certification of welders employed on the Work, verifying AWS qualification within the previous 12 months.

D. Sustainability and LEED Standards Certification:
   1. Regional manufactured products with percentage by weight.
   2. Recycled content calculated as 1/2 preconsumer + postconsumer.

PART 2 PRODUCTS

2.01 METAL STAIRS - GENERAL

A. Metal Stairs: Provide stairs of the design specified, complete with landing platforms, vertical and horizontal supports, railings, and guards, fabricated accurately for anchorage to each other and to building structure.
   1. Regulatory Requirements: Provide stairs and railings complying with the most stringent requirements of local, state, and federal regulations; where requirements of the contract documents exceed those of regulations, comply with the contract documents.
   2. Handrails: Comply with applicable accessibility requirements of ADA Standards.
   3. Structural Design: Provide complete stair and railing assemblies complying with the applicable local code.
      a. Refer to structural drawings for stair construction notes and design loads.
   4. Dimensions: As indicated on drawings.
   5. Shop assemble components; disassemble into largest practical sections suitable for transport and access to site.
   6. No sharp or rough areas on exposed travel surfaces and surfaces accessible to touch.
   7. Separate dissimilar metals using paint or permanent tape.

B. Metal Jointing and Finish Quality Levels:
   1. Architectural: All joints as inconspicuous as possible, whether welded or mechanical.
      a. Welded Joints: Continuously welded and ground smooth and flush.
      b. Mechanical Joints: Butted tight, flush, and hairline; concealed fastenings only.
      c. Exposed Edges and Corners: Eased to small uniform radius.
      d. Metal Surfaces to be Painted: Sanded or ground smooth, suitable for highest quality gloss finish.

2. Commercial: Exposed joints as inconspicuous as possible, whether welded or mechanical; underside of stair not covered by soffit IS considered exposed to view.
   a. Welded Joints: Intermittently welded on back side, filled with body putty, and sanded smooth and flush.
   b. Welds Exposed to View: Ground smooth and flush.
   c. Mechanical Joints: Butted tight, flush, and hairline.
   d. Bolts Exposed to View: Countersunk flat or oval head bolts; no exposed nuts.
   e. Exposed Edges and Corners: Eased to small uniform radius.
   f. Metal Surfaces to be Painted: Sanded or ground smooth, suitable for satin or matte finish.

C. Fasteners: Same material or compatible with materials being fastened; type consistent with design and specified quality level.

D. Anchors and Related Components: Same material and finish as item to be anchored, except where specifically indicated otherwise; provide all anchors and fasteners required.

2.02 METAL STAIRS WITH PRECAST TERRAZZO TREADS AND LANDINGS

A. Jointing and Finish Quality Level: Architectural, as defined above.

B. Risers: Closed.

C. Treads: Metal pan with precast terrazzo treads.
   1. Precast Concrete Tread Thickness: 2 inches, minimum. See Section 09 66 16.
   2. Tread Pan Material: Steel sheet.
   3. Tread Pan Thickness: As required by design; 14 gage, 0.075 inch minimum.
   4. Pan Anchorage to Stringers: Continuously welded, from top or bottom.

D. Risers: Same material and thickness as tread pans.
   1. Riser/Nosing Profile: As shown on drawings.

E. Stringers: Rolled steel channels.
   1. Stringer Depth: As indicated on drawings.
   2. End Closure: Sheet steel of same thickness as risers welded across ends.

F. Landings: Same construction as treads, supported and reinforced as required to achieve design load capacity.

G. Railings: Steel pipe railings.

H. Finish: Shop- or factory-prime painted.

I. Under Side of Stair: Not exposed to view.

2.03 METAL STAIRS WITH CONCRETE TREADS

A. Jointing and Finish Quality Level: Commercial, as defined above.

B. Risers: Closed.

C. Treads: Metal pan with concrete fill.
   1. Concrete Depth: 2 inches, minimum.
   2. Tread Pan Material: Steel sheet.
   3. Tread Pan Thickness: As required by design; 14 gage, 0.075 inch minimum.
   4. Pan Anchorage to Stringers: Continuously welded, from top or bottom.
   5. Concrete Reinforcement: None.
   6. Concrete Finish: For resilient floor covering.

D. Risers: Same material and thickness as tread pans.

1. Riser/Nosing Profile: Vertical riser with underside of nosing sloped up from bottom of tread pan at not less than 60 degrees from horizontal, with rounded top of nosing of minimum radius.
2. Nosing Depth: Not more than 1 inch overhang.
3. Nosing Return: Flush with top of concrete fill, not more than 1/2 inch wide.

E. Stringers: Rolled steel channels.
1. Stringer Depth: 10 inches.
2. End Closure: Sheet steel of same thickness as risers welded across ends.

F. Landings: Same construction as treads, supported and reinforced as required to achieve design load capacity.

G. Railings: Steel pipe railings.

H. Finish: Shop- or factory-prime painted.

I. Under Side of Stair: Not exposed to view.

2.04 HANDRAILS AND GUARDS

A. Wall-Mounted Rails: As specified in Section 05 52 13.

B. Guards: As specified in Section 05 52 13.

2.05 MATERIALS

A. Steel Sections: ASTM A36/A36M.

B. Steel Plates: ASTM A6/A6M or ASTM A283/A283M.

C. Ungalvanized Steel Sheet: Hot- or cold-rolled, except use cold-rolled where finished work will be exposed to view.
1. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Designation CS (commercial steel).
2. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Designation CS (commercial steel).

D. Concrete Fill: Type specified in Section 03 30 00.

2.06 ACCESSORIES

A. Steel Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1

B. Steel Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, and galvanized to ASTM A153/A153M where connecting galvanized components.

C. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

D. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.07 SHOP FINISHING

A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

B. Do not prime surfaces in direct contact with concrete or where field welding is required.

C. Prime Painting: Use specified shop- and touch-up primer.
1. Preparation of Steel: In accordance with SSPC-SP 2, Hand Tool Cleaning.
2. Number of Coats: Two.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. When field welding is required, clean and strip primed steel items to bare metal.

B. Supply items required to be embedded in masonry with setting templates.

3.03 INSTALLATION

A. Install components plumb and level, accurately fitted, free from distortion or defects.

B. Provide anchors, plates, angles, hangers, and struts required for connecting stairs to structure.

C. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

D. Provide welded field joints where specifically indicated on drawings. Perform field welding in accordance with AWS D1.1/D1.1M.

E. Other field joints may be either welded or bolted provided the result complies with the limitations specified for jointing quality levels.

F. Obtain approval prior to site cutting or creating adjustments not scheduled.

G. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

END OF SECTION

SECTION 05 52 13
PIPE AND TUBE RAILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall mounted handrails.

B. Free-standing railings at steps.

1.02 RELATED REQUIREMENTS

A. Section 01 74 19 – Construction Waste Management.

B. Section 01 81 13 – Sustainable Design Requirements.

C. Section 01 81 19 – Indoor Air Quality Requirements.

D. Section 05 51 00 - Metal Stairs: Handrails other than those specified in this section.

E. Section 09 21 16 - Gypsum Board Assemblies: Placement of backing plates in stud wall construction.

F. Section 09 90 00 - Paints and Coatings

1.03 LEED REQUIREMENTS

A. LEED Focus Materials (LFMs) For This Section
   1. Targeted products containing Recycled Content (MRc4)
   2. Targeted products containing Regional Material (MRc5)

1.04 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

C. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2013.

D. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings; 2013, with Editorial Revision.

E. ASTM E985 - Standard Specification for Permanent Metal Railing Systems and Rails for Buildings; 2000 (Reapproved 2006).

F. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 1999 (Ed. 2004).

1.05 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

C. LEED Product and Material Data Summary Form: For all installed products and materials of this Section, complete the “LEED Product and Material Data Summary Form” (attached to end of Section 01 81 13 - Sustainable Design Requirements)

1. Product Material Cost: Provide the cost for material, or an assembled product, including taxes and delivery but excluding any cost for labor and equipment required for installation after the material is delivered to the site.
2. Product Data for Credit MRc4, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating cost for each product having recycled content.
3. Product Data for Credit MRc5, Regional Material: For products having regional materials, documentation indicating location of raw material extraction, harvest or recovery, as well as, manufacture (location of final assembly) within 500 miles of project site. Include statement indicating cost for each material or component of the assembled product.

1.06 QUALITY ASSURANCE

A. Sustainability and LEED Standards Certification:
   1. Regional manufactured products with percentage by weight.
   2. Recycled content calculated as 1/2 preconsumer + postconsumer.

PART 2 PRODUCTS

2.01 RAILINGS - GENERAL REQUIREMENTS

A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of ASTM E985 and applicable local code.

B. Distributed Loads: Design railing assembly, wall rails, and attachments to resist distributed force of 75 pounds per linear foot applied to the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E935.

C. Concentrated Loads: Design railing assembly, wall rails, and attachments to resist a concentrated force of 200 pounds applied at any point on the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E935.

D. Allow for expansion and contraction of members and building movement without damage to connections or members.

E. Dimensions: See drawings for configurations and heights.

F. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.

G. Provide welding fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.

2.02 STEEL RAILING SYSTEM

A. Exterior railings and guards:
   1. Stainless steel.

B. Interior railings and guards:
   1. Painted steel, with stainless steel handrails and top guard.
   2. Wall and Post-Mounted Handrails: Stainless Steel, Round pipe unless otherwise indicated.
      a. Outside Diameter: 1-1/4 inch, minimum, to 1-1/2 inches, maximum.
   3. Guards:

a. Top Rails: Stainless steel, round pipe unless otherwise indicated.
   1) Outside Diameter: 1-1/2 inch, minimum, to 2 inches, maximum.
b. Infill at Picket Railings: Vertical pickets.
   1) Horizontal Spacing: Maximum 4 inches on center.
   2) Material: Solid steel bar.
   3) Shape: Square.
   4) Size: 1/2 inchsquare.
   5) Top Mounting: Welded to steel channel at underside of top rail.
   6) Bottom Mounting: Welded to 1-1/2" square bottom rail.
c. c. End and Intermediate Posts: Square tube.
   1) Horizontal Spacing: As required to meet design loads.
   2) Mounting: Welded to top surface of stringer.

C. Steel Tube: ASTM A500/A500M, Grade B cold-formed structural tubing.

D. Steel Pipe: ASTM A53/A53M, Grade B Schedule 80, black finish.

E. Welding Fittings: Factory- or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.

F. Exposed Fasteners: No exposed bolts or screws.

G. Straight Splice Connectors: Steel concealed spigots.

H. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.03 FABRICATION

A. Accurately form components to suit specific project conditions and for proper connection to building structure.

B. Fit and shop assemble components in largest practical sizes for delivery to site.

C. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.

D. Welded Joints:
   1. Exterior Components: Continuously seal joined pieces by continuous welds. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.
   2. Interior Components: Continuously seal joined pieces by continuous welds.
   3. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply items required to be embedded in masonry with setting templates, for installation as work of other sections.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.

C. Install railings in compliance with ADA Standards for accessible design at applicable locations.

D. Anchor railings securely to structure.

E. Field weld anchors as indicated on drawings. Touch-up welds with primer. Grind welds smooth.

F. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

3.04 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per floor level, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

SECTION 05 75 00
DECORATIVE FORMED METAL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior fabrications made of formed metal sheet, secondary supports, and anchors to structure, including:
   1. Factory fabricated column covers.

1.02 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Submit complete shop drawings indicating quanitities, dimensions, finishes, and attachment details.

C. Submit manufacturer's product data, specification, and installation instructions.

D. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.

E. Maintenance Data: Care of finishes and warranty requirements.

1.03 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating products specified in this section.
   1. With not less than 5 years of documented experience.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in manufacturer's original, unopened, undamaged containers with identification labels intact.
   1. Protect finishes by applying heavy duty removable plastic film during production.
   2. Package for protection against transportation damage.
   3. Provide markings to identify components consistently with drawings.
   4. Exercise care in unloading, storing and installing panels to prevent bending, warping, twisting and surface damage.

B. Store products protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
   1. Store in well ventilated space out of direct sunlight.
   2. Protect from moisture and condensation with tarpaulins or other suitable weather tight covering installed to provide ventilation.
   3. Store at a slope to ensure positive drainage of any accumulated water.
   4. Do not store in any enclosed space where ambient temperature can exceed 120 degrees F.
   5. Avoid contact with any other materials that might cause staining, denting, or other surface damage.

C. To prevent adhesive transfer to finish, panels must not be stored for prolonged periods of time, be stored in direct sunlight, or be subjected to high heat prior to installation.

1.05 WARRANTY

A. Provide manufacturer's warranty against defects in material and workmanship for a period of 1 year.

PART 2 PRODUCTS

2.01 FORMED METAL FABRICATIONS - GENERAL

A. Shop Assembly: Preassemble items to greatest extent possible. Minimize field splices and field assembly. Disassemble only as necessary for transportation and handling. Mark items clearly for assembly and installation.

B. Coordination: Match dimensions and attachment of formed metal items to adjacent construction. Produce integrated assemblies. Closely fit joints; align edges and flat surfaces unless indicated otherwise.

C. Forming: Profiles indicated. Maximize lengths. Fold exposed edges to form hem indicated or ease edges to radius indicated with concealed stiffener. Provide flat, flush surfaces without cracking or grain separation at bends.

D. Reinforcement: Increase metal thickness; use concealed stiffeners, backing materials or both. Provide stretcher leveled standard of flatness and stiffness required to maintain flatness and hold adjacent items in flush alignment.

E. Anchors: Straps, plates and anchors as required to support and anchor items to adjacent construction.

F. Supports: Miscellaneous framing, mounting, clips, sleeves, fasteners and accessories required for installation.

2.02 FACTORY FABRICATED COLUMN COVERS

A. Factory Fabricated Column Covers: Factory fabricated and factory finished, sheet metal column covers, mechanically fastened to structural support.
   1. Material: Aluminum sheet, ASTM B209 or ASTM B209M, alloy 3003 or 5005.
   2. Sheet Thickness: 0.125 inch, minimum.
   3. Column Section Length: 12 feet, maximum, between horizontal joints.
   4. Joint Type: Soft V butt joints.
   5. Horizontal Reveals: Manufacturer's standard; at top and bottom.
   6. Fasteners: Self-drilling; ASTM A449 heat treated steel, with manufacturer's standard corrosion resistant coating. Column shall have no exposed fasteners unless specified.
   7. Aluminum Finish: Manufacturer's standard factory applied PVDF coating.
   8. Color: To be selected by Architect from manufacturer's standard range.
   9. Manufacturers:
      a. Fry Reglet Corp.; Model KS: www.fryreglet.com
      b. SAF Metal Fabrication, a division of Southern Aluminum Finishing Company, Inc; C-1000: www.saf.com/#sle.
      c. Firestone Building Products; www.firestonebpco.com
      d. Gordon Incorporated; www.gordon-inc.com
      e. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 MATERIALS

A. General: Provide sheet metal without pitting, seam marks, roller marks, stains, discolorations, or other imperfections exposed to view on finished units.

B. Provide additional bracing components as necessary to stiffen substructure and insure solid mid-span bracing and connections. (by others)

C. Fasteners, General: Same basic metal and alloy as formed metal sheet unless indicated otherwise. Do not use metals incompatible with the materials joined.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and interfaces with other work.

B. Verify substrate on-site to determine that conditions are acceptable for product installation in accordance with manufacturer's written instructions.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

D. Notify Architect in writing of conditions detrimental to proper and timely completion of work. Do not proceed with erection until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Protect adjacent work areas and finish surfaces from damage during installation.

B. Verify/coordinate with other trades prior to installation insofar as they are affected by column cover installation.

3.03 INSTALLATION

A. Install components in accord with manufacturer's installation instructions and approved shop drawings.

B. Anchor components to related structures such as floors, walls, and beams as indicated on approved shop drawings. Use anchors with holding strength to provide a solid installation. Use only plated, galvanized or stainless steel anchors.

3.04 CLEANING

A. Restore finishes damaged during installation and construction period. Return items that cannot be refinished in the field to manufacturer or fabricator. Refinish entire unit or provide new units.

B. Remove protective film after installation of joint sealers, after cleaning of adjacent materials, and immediately prior to completion of work.

C. Clean installed products in accordance with manufacturer's instructions.

D. Visually inspect all exposed surfaces for scratches or blemishes.

3.05 PROTECTION

A. Protect installed products from damage during remainder of construction period.

END OF SECTION

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SECTION 06 10 00
ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-structural dimension lumber framing.

B. Rough opening framing for doors, windows, and roof openings.

C. Roof-mounted curbs.

D. Roofing nailers.

E. Roofing cant strips.

F. Preservative treated wood materials.

G. Fire retardant treated wood materials.

H. Miscellaneous framing and sheathing.

I. Communications and electrical room mounting boards.

J. Concealed wood blocking, nailers, and supports.

K. Miscellaneous wood nailers, furring, and grounds.

1.02 RELATED REQUIREMENTS

A. Section 01 74 19 – Construction Waste Management.

B. Section 01 81 13 – Sustainable Design Requirements.

C. Section 01 81 14 – Volatile Organic Compound (VOC) Limits For Adhesives, Sealants, Paints & Coatings.

D. Section 01 81 19 – Indoor Air Quality Requirements.

E. Section 03 30 00 - Cast-in-Place Concrete: Setting anchors in concrete.

F. Section 07 25 00 - Weather Barriers: Water-resistive barrier over sheathing.

1.03 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

C. ASTM D2898 - Standard Test Methods for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing; 2010.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.

E. AWPA U1 - Use Category System: User Specification for Treated Wood; 2016.

F. PS 1 - Structural Plywood; 2009.

G. PS 20 - American Softwood Lumber Standard; 2015.

1.04 LEED REQUIREMENTS

A. LEED Focus Materials (LFMs) For This Section:

1. Targeted products containing Recycled Content (MRc4)
2. Targeted products containing Regional Material (MRc5)
3. Targeted products to meet Composite Wood & Agrifiber requirements (EQc4.4)

1.05 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Product Data: Provide technical data on wood preservative materials and application instructions.

C. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.

D. ABAA Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.

E. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

F. LEED Product and Material Data Summary Form: For all installed products and materials of this Section, complete the “LEED Product and Material Data Summary Form” (attached to end of Section 01 81 13 - Sustainable Design Requirements)
   1. Product Material Cost: Provide the cost for material, or an assembled product, including taxes and delivery but excluding any cost for labor and equipment required for installation after the material is delivered to the site.
   2. Product Data for Credit MRc4, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating cost for each product having recycled content.
   3. Product Data for Credit MRc5, Regional Material: For products having regional materials, documentation indicating location of raw material extraction, harvest or recovery, as well as, manufacture (location of final assembly) within 500 miles of project site. Include statement indicating cost for each material or component of the assembled product.
   4. Product Data for Credit EQc4.4, Composite Wood & Agrifiber Products: Product data sheets, MSDS, certificates or letter from product manufacture highlighting that the composite wood or agrifiber product and/or associated laminating adhesive do not contain urea-formaldehyde resin.

1.06 QUALITY ASSURANCE

A. Air Barrier Association of America (ABAA) Evaluated Materials Program (EAP); www.airbarrier.org/#sle: Use evaluated materials from a single manufacturer regularly engaged in air barrier material manufacture. Use secondary materials approved in writing by primary material manufacturer.

B. Sustainability and LEED Standards Certification:
   1. Regional manufactured products with percentage by weight.
   2. Recycled content calculated as 1/2 preconsumer + postconsumer.
   3. VOC content limitations defined in Section 018114, "Volatile Organic Compound (VOC) Limits For Adhesives, Sealants, Paints, and Coatings."
   4. No Added Urea Formaldehyde in product.

1.07 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

1.08 WARRANTY

A. See Section 01 77 00 - Closeout Procedures, for additional warranty requirements.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
   1. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.
   2. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

B. Lumber fabricated from old growth timber is not permitted.

C. Provide sustainably harvested wood; see Section 01 60 00 - Product Requirements for requirements.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Sizes: Nominal sizes as indicated on drawings, S4S.

B. Moisture Content: S-dry or MC19.

C. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
   1. Lumber: S4S, No. 2 or Standard Grade.
   2. Boards: Standard or No. 3.

2.03 CONSTRUCTION PANELS

A. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

B. Other Applications:
   1. Plywood Concealed From View But Located Within Exterior Enclosure: PS 1, C-C Plugged or better, Exterior grade.
   2. Other Locations: PS 1, C-D Plugged or better.

2.04 ACCESSORIES

A. Fasteners and Anchors:
   1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
   2. Drywall Screws: Bugle head, hardened steel, power driven type, length three times thickness of sheathing.
   3. Anchors: Toggle bolt type for anchorage to hollow masonry.

2.05 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
   1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
   2. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

B. Fire Retardant Treatment:
   1. Manufacturers:
      a. Arch Wood Protection, Inc: www.wolmanizedwood.com
      b. Hoover Treated Wood Products, Inc: www.frtw.com.
      c. Koppers, Inc: www.koppersperformancechemicals.com/#sle.
      d. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Exterior Type: AWPA U1, Category UCFB, Commodity Specification H, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes both before and after accelerated weathering test performed in accordance with ASTM D2898.
      a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
      b. Treat plywood panels that are a substrate for ACM Fascia Panels, and HPL panels.
      c. Treat other rough carpentry items as indicated.
      d. Do not use treated wood in direct contact with the ground.
   3. Interior Type A: AWPA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.
      a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
      b. Treat rough carpentry items as indicated .
      c. Do not use treated wood in applications exposed to weather or where the wood may become wet.

C. Preservative Treatment:
   1. Manufacturers:
      a. Arch Wood Protection, Inc: www.wolmanizedwood.com.
      b. Koppers Performance Chemicals, Inc: www.koppersperformancechemicals.com.
      c. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative.
      a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
      b. Treat lumber in contact with roofing, flashing, or waterproofing.
      c. Treat lumber in contact with masonry or concrete.
      d. Treat lumber less than 18 inches above grade.

e. Treat lumber in other locations as indicated.

3. Preservative Pressure Treatment of Plywood Above Grade: AWPA U1, Use Category UC2 and UC3B, Commodity Specification F using waterborne preservative.
   a. Kiln dry plywood after treatment to maximum moisture content of 19 percent.
   b. Treat plywood in contact with roofing, flashing, or waterproofing.
   c. Treat plywood in contact with masonry or concrete.
   d. Treat plywood less than 18 inches above grade.
   e. Treat plywood in other locations as indicated.
   f. Treat plywood used for wood blocking within cavity wall construction.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.02 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.

C. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

D. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

E. Provide the following specific non-structural framing and blocking:
   1. Cabinets and shelf supports.
   2. Wall brackets.
   3. Handrails.
   4. Grab bars.
   5. Towel and bath accessories.
   6. Wall-mounted door stops.
   7. Tack boards and marker boards.
   8. Wall paneling and trim.
   9. Joints of rigid wall coverings that occur between studs.
   10. TV and monitor mounts.
   11. Other locations as detailed and/or required.

3.03 ROOF-RELATED CARPENTRY

A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.

B. Provide wood curb at all roof openings except where specifically indicated otherwise. Form corners by alternating lapping side members.

3.04 INSTALLATION OF CONSTRUCTION PANELS

A. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using screws.
   1. At long edges proved solid edge blocking where joints occur between roof framing members.
   2. Provide inlet diagonal bracing at corners.
   3. Place water-resistive barrier horizontally over wall sheathing, weather lapping edges and ends.

B. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on all edges and into studs in field of board.
   1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
   2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
   3. Install adjacent boards without gaps.

3.05 SITE APPLIED WOOD TREATMENT

A. Apply preservative treatment compatible with factory applied treatment at site-sawn cuts, complying with manufacturer's instructions.

B. Allow preservative to dry prior to erecting members.

3.06 CLEANING

A. Waste Disposal: Comply with the requirements of Section 01 74 19 - Construction Waste Management and Disposal.
   1. Comply with applicable regulations.
   2. Do not burn scrap on project site.
   3. Do not burn scraps that have been pressure treated.
   4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.

B. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.

C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

SECTION 06 20 00
FINISH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Finish carpentry items.
   1. Custom plastic laminate and solid surfacing reception desk.
   2. Solid surfacing window stools.
   3. Standing and running wood trim.
   4. Wood veneer paneling
   5. Plastic laminate veneer paneling
   6. Hang doors, install hardware.

B. Hardware and attachment accessories.

1.02 RELATED REQUIREMENTS

A. Section 01 74 19 – Construction Waste Management.

B. Section 01 81 13 – Sustainable Design Requirements.

C. Section 01 81 14 – Volatile Organic Compound (VOC) Limits For Adhesives, Sealants, Paints & Coatings.

D. Section 01 81 19 – Indoor Air Quality Requirements.

E. Section 06 10 00 - Rough Carpentry: Support framing, grounds, and concealed blocking.

F. Section 08 14 16 - Flush Wood Doors.

G. Section 08 80 00 - Glazing:

H. Section 09 91 23 - Interior Painting: Painting and finishing of finish carpentry items.

I. Section 12 36 01 - Countertops, Backsplashes, and Window Stools: Solid surface material.

1.03 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.

B. AWI (QCP) - Quality Certification Program; current edition at www.awiqcp.org.

C. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.

D. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.0; 2016.

E. AWPA U1 - Use Category System: User Specification for Treated Wood; 2016.

F. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; 2016.

G. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

H. NHLA G-101 - Rules for the Measurement & Inspection of Hardwood & Cypress; 2011.

I. PS 1 - Structural Plywood; 2009.

J. PS 20 - American Softwood Lumber Standard; 2015.

K. WDMA I.S. 4 - Industry Specification for Preservative Treatment for Millwork; 2013.

1.04 LEED REQUIREMENTS

A. LEED Focus Materials (LFMs) For This Section:
   1. Targeted products containing Recycled Content (MRc4)
   2. Targeted products containing Regional Material (MRc5)
   3. Targeted products to meet Composite Wood & Agrifiber requirements (EQc4.4)

1.05 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination for submittal procedures.

B. Product Data:
   1. Provide data on fire retardant treatment materials and application instructions.

C. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
   1. Provide the information required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
   2. Include certification program label.

D. Samples: Submit two samples of finish plywood, 6 by 6 inch in size illustrating wood grain and specified finish.

E. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

F. LEED Product and Material Data Summary Form: For all installed products and materials of this Section, complete the "LEED Product and Material Data Summary Form" (attached to end of Section 01 81 13 - Sustainable Design Requirements)
   1. Product Material Cost: Provide the cost for material, or an assembled product, including taxes and delivery but excluding any cost for labor and equipment required for installation after the material is delivered to the site.
   2. Product Data for Credit MRc4, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating cost for each product having recycled content.
   3. Product Data for Credit MRc5, Regional Material: For products having regional materials, documentation indicating location of raw material extraction, harvest or recovery, as well as, manufacture (location of final assembly) within 500 miles of project site. Include statement indicating cost for each material or component of the assembled product.
   4. Product Data for Credit EQc4.4, Composite Wood & Agrifiber Products: Product data sheets, MSDS, certificates or letter from product manufacture highlighting that the composite wood or agrifiber product and/or associated laminating adhesive do not contain urea-formaldehyde resin.

1.06 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
   1. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
   2. Single Source Responsibility: Provide and install this work from single fabricator.

B. Quality Certification:

1. Comply with AWI (QCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section: www.awiqcp.org/#sle.
2. Provide labels or certificates indicating that the work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
3. Provide designated labels on shop drawings as required by certification program.
4. Provide designated labels on installed products as required by certification program.
5. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

C. Sustainability and LEED Standards Certification:
1. Regional manufactured products with percentage by weight.
2. Recycled content calculated as 1/2 preconsumer + postconsumer.
3. VOC content limitations defined in Section 018114, "Volatile Organic Compound (VOC) Limits For Adhesives, Sealants, Paints, and Coatings."
4. No Added Urea Formaldehyde in product.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect work from moisture damage.

PART 2 PRODUCTS

2.01 FINISH CARPENTRY ITEMS

A. Quality Standard: Premium Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Interior Woodwork Items:
1. Moldings, Bases, Casings, and Miscellaneous Trim: Clear white pine; prepare for paint finish.
2. Wall panels: White maple veneer plywood; prepare for transparent finish.
3. Custom Reception desks, plastic laminate finish.

2.02 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.

2.03 LUMBER MATERIALS

A. Softwood Lumber: White Pine species, quarter sawn, maximum moisture content of 6 percent; with vertical grain, of quality suitable for paint finish.

B. Hardwood Lumber: White Maple species, quarter sawn, maximum moisture content of 6 percent; with vertical grain, of quality suitable for transparent finish.

2.04 SHEET MATERIALS

A. Hardwood Plywood: Face species White Maple, quarter cut, book matched, medium density fiberboard core; HPVA HP-1, Front Face Grade AA, Back Face Grade 1, glue type as recommended for application.

2.05 PLASTIC LAMINATE MATERIALS

A. Plastic Laminate: NEMA LD 3, HGS; color as selected by Architect.

B. Laminate Backing Sheet: NEMA LD 3, BKL; undecorated plastic laminate.

C. Laminate Adhesive: Type recommended by laminate manufacturer to suit application; not containing formaldehyde or other volatile organic compounds.

2.06 FASTENINGS

A. Adhesive for Purposes Other Than Laminate Installation: Suitable for the purpose; not containing formaldehyde or other volatile organic compounds.

B. Concealed Joint Fasteners: Threaded steel.

2.07 ACCESSORIES

A. Aluminum Millwork Trims: Extruded shape; smooth surface finish.
   1. Finish: Clear anodized
   2. Shapes: As indicated on drawings
   3. Manufacturers:
      a. Fry Reglet Corp.; Millwork Trims: www.fryreglet.com
      b. Substitutions: See Section 01 60 00 - Product Requirements.

B. Primer: As specified in Section 09 90 00.

C. Wood Filler: Solvent base, tinted to match surface finish color.

2.08 WOOD TREATMENT

A. Fire Retardant Treatment (FR-S Type): Chemically treated and pressure impregnated; capable of providing flame spread index of 25, maximum, and smoke developed index of 450, maximum, when tested in accordance with ASTM E84.

B. Wood Preservative by Pressure Treatment (PT Type): Provide AWPA U1 treatment using waterborne preservative with 0.25 percent retainage.

C. Shop pressure treat wood materials requiring fire rating to concealed wood blocking.

D. Provide identification on fire retardant treated material.

E. Redry wood after pressure treatment to maximum 10 percent moisture content.

2.09 FABRICATION

A. Shop assemble work for delivery to site, permitting passage through building openings.

B. Cap exposed plastic laminate finish edges with material of same finish and pattern.

C. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

D. Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.

E. Apply laminate backing sheet to reverse face of plastic laminate finished surfaces.

2.10 SHOP FINISHING

A. Apply wood filler in exposed nail and screw indentations.

B. On items to receive transparent finishes, use wood filler that matches surrounding surfaces and is of type recommended for the applicable finish.

C. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
   1. Transparent:
      a. System - 11, Polyurethane, Catalyzed.
      b. Sheen: Satin.

D. Back prime woodwork items to be field finished, prior to installation.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

3.02 INSTALLATION

A. Hang doors and install hardware

B. Install work in accordance with AWI/AWMAC/WI (AWS) requirements for grade indicated.

C. Set and secure materials and components in place, plumb and level.

D. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.

E. Install interior wood trim with finish nails or finish screws, set for filler.

F. Install solid surface window stools.

3.03 SITE APPLIED WOOD TREATMENT

A. Apply preservative treatment in accordance with manufacturer's instructions.

B. Brush apply one coats of preservative treatment on wood in contact with cementitious materials. Treat site-sawn cuts.

C. Allow preservative to dry prior to erecting members.

3.04 PREPARATION FOR SITE FINISHING

A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.

B. Before installation, prime paint surfaces of items or assemblies to be in contact with cementitious materials.

3.05 TOLERANCES

A. Maximum Variation from True Position: 1/16 inch.

B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

END OF SECTION

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SECTION 07 11 13
BITUMINOUS DAMPPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Bituminous dampproofing.

B. Protection boards.

C. Drainage panels.

1.02 RELATED REQUIREMENTS

A. Section 01 74 19 – Construction Waste Management.

B. Section 01 81 13 – Sustainable Design Requirements.

C. Section 01 81 14 – Volatile Organic Compound (VOC) Limits For Adhesives, Sealants, Paints & Coatings.

D. Section 01 81 19 – Indoor Air Quality Requirements.

1.03 REFERENCE STANDARDS

A. ASTM D41/D41M - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing; 2011 (Reapproved 2016).

B. ASTM D1187/D1187M - Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal; 1997 (Reapproved 2011).

C. ASTM D1227 - Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing; 2013.

1.04 LEED REQUIREMENTS

A. LEED Focus Materials (LFMs) For This Section:
   1. Targeted products containing Recycled Content (MRc4)
   2. Targeted products containing Regional Material (MRc5)
   3. Targeted products to meet VOC requirements (EQc4.1 & EQc4.2)

1.05 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Product Data: Provide properties of primer, bitumen, and mastics.

C. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

D. LEED Product and Material Data Summary Form: For all installed products and materials of this Section, complete the “LEED Product and Material Data Summary Form” (attached to end of Section 01 81 13 - Sustainable Design Requirements)
   1. Product Material Cost: Provide the cost for material, or an assembled product, including taxes and delivery but excluding any cost for labor and equipment required for installation after the material is delivered to the site.
   2. Product Data for Credit MRc4, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating cost for each product having recycled content.

3. Product Data for Credit MRc5, Regional Material: For products having regional materials, documentation indicating location of raw material extraction, harvest or recovery, as well as, manufacture (location of final assembly) within 500 miles of project site. Include statement indicating cost for each material or component of the assembled product.
4. Product Data for Credit EQc4.1, Adhesives & Sealants: For adhesives and sealants, documentation including printed statement of VOC content and chemical components.

1.06 QUALITY ASSURANCE

A. Sustainability and LEED Standards Certification:
   1. Regional manufactured products with percentage by weight.
   2. Recycled content calculated as 1/2 preconsumer + postconsumer.
   3. VOC content limitations defined in Section 018114, "Volatile Organic Compound (VOC) Limits For Adhesives, Sealants, Paints, and Coatings."

B. Installer Qualifications: Company specializing in performing the work of this section with at least three years of documented experience.

1.07 FIELD CONDITIONS

A. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application until dampproofing has cured.

PART 2 PRODUCTS

2.01 BITUMINOUS DAMPPROOFING

A. Bituminous Dampproofing: Cold-applied water-based emulsion; asphalt with mineral colloid or chemical emulsifying agent; with or without fiber reinforcement; asbestos-free; suitable for application on vertical and horizontal surfaces.
   1. Composition - Vertical Application: ASTM D1227 Type III or ASTM D1187/D1187M Type I.
   2. VOC Content: Not more than permitted by local, State, and federal regulations.
   3. Applied Thickness: 1/16 inch, minimum, wet film.
   4. Products:
      a. W. R. Meadows, Inc; Sealmastic Emulsion Type I (spray-grade): www.wrmeadows.com/sle.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

B. Primers, Mastics, and Related Materials: Type as recommended by dampproofing manufacturer.

2.02 BITUMEN MATERIALS

A. Cold Asphaltic Type:
   1. Bitumen: Emulsified asphalt, ASTM D1227;unreinforced (Type III).
   2. Asphalt Primer: ASTM D41/D41M, compatible with substrate.

2.03 ACCESSORIES

A. Drainage Panel: 1/4 inch thick formed plastic, hollowed sandwich.

B. Protection Board: 1/8 inch thick biodegradable hardboard.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions are acceptable prior to starting this work.

B. Verify substrate surfaces are durable, free of matter detrimental to adhesion or application of dampproofing system.

C. Verify that items penetrating surfaces to receive dampproofing are securely installed.

3.02 PREPARATION

A. Protect adjacent surfaces not designated to receive dampproofing.

B. Clean and prepare surfaces to receive dampproofing in accordance with manufacturer's instructions.

C. Do not apply dampproofing to surfaces unacceptable to manufacturer.

D. Apply mastic to seal penetrations, small cracks, or minor honeycombs in substrate.

3.03 APPLICATION

A. Foundation Walls: Apply two coats of asphalt dampproofing.

B. Perform this work in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.

C. Prime surfaces at a rate approved by manufacturer for application indicated, and allow primer to dry thoroughly.

D. Apply bitumen by spray application.

E. Apply bitumen in one coat, continuous and uniform, at a rate of 25 sq ft/gal per coat.

F. Apply from 2 inches below finish grade elevation down to top of footings.

G. Seal items watertight with mastic, that project through dampproofing surface.

H. Place drainage panel directly over dampproofing, butt joints, place to encourage drainage downward.

I. Place protection board over drainage panel, butt joints, and adhere with mastic.

J. Scribe and cut boards around projections, penetrations, and interruptions.

END OF SECTION

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SECTION 07 13 00
SHEET WATERPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sheet Waterproofing:
   1. Self-adhered modified bituminous sheet membrane.
   2. Self-adhered HDPE sheet membrane.

B. Drainage panels and protection board.

1.02 RELATED REQUIREMENTS

A. Section 01 74 19 – Construction Waste Management.

B. Section 01 81 13 – Sustainable Design Requirements.

C. Section 01 81 14 – Volatile Organic Compound (VOC) Limits For Adhesives, Sealants, Paints & Coatings.

D. Section 01 81 19 – Indoor Air Quality Requirements.

E. Section 03 30 00 - Cast-in-Place Concrete: Concrete substrate.

F. Section 04 20 00 - Unit Masonry : CMU Substrate

G. Section 07 92 00 - Joint Sealants: Sealing moving joints in waterproofed surfaces that are not required to be treated in this section.

1.03 ABBREVIATIONS

A. HDPE - High-Density Polyethylene.

B. NRCA - National Roofing Contractors Association.

1.04 REFERENCE STANDARDS

A. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2006a (Reapproved 2015a).

B. ASTM D570 - Standard Test Method for Water Absorption of Plastics; 1998 (Reapproved 2010).

C. ASTM D882 - Standard Test Method for Tensile Properties of Thin Plastic Sheeting; 2012.

D. ASTM D903 - Standard Test Method for Peel or Stripping Strength of Adhesive Bonds; 1998 (Reapproved 2010).

E. ASTM D1876 - Standard Test Method for Peel Resistance of Adhesives (T-Peel Test); 2008 (Reapproved 2015).

F. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2015a.

G. ASTM D5385/D5385M - Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes; 1993, with Editorial Revision (2014).

H. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.

I. ASTM E154/E154M - Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover; 2008a (Reapproved 2013).

J. NRCA (WM) - The NRCA Waterproofing Manual; 2005.

1.05 LEED REQUIREMENTS

A. LEED Focus Materials (LFMs) For This Section:
   1. Targeted products containing Recycled Content (MRc4)
   2. Targeted products containing Regional Material (MRc5)
   3. Targeted products to meet VOC requirements (EQc4.1 & EQc4.2)

1.06 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Product Data: Provide data for membrane.

C. Shop Drawings: Indicate special joint or termination conditions and conditions of interface with other materials.

D. Certificate: Certify that products meet or exceed specified requirements.

E. Manufacturer's Installation Instructions: Indicate special procedures.

F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

G. LEED Product and Material Data Summary Form: For all installed products and materials of this Section, complete the “LEED Product and Material Data Summary Form” (attached to end of Section 01 81 13 - Sustainable Design Requirements)
   1. Product Material Cost: Provide the cost for material, or an assembled product, including taxes and delivery but excluding any cost for labor and equipment required for installation after the material is delivered to the site.
   2. Product Data for Credit MRc4, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating cost for each product having recycled content.
   3. Product Data for Credit MRc5, Regional Material: For products having regional materials, documentation indicating location of raw material extraction, harvest or recovery, as well as, manufacture (location of final assembly) within 500 miles of project site. Include statement indicating cost for each material or component of the assembled product.
   4. Product Data for Credit EQc4.1, Adhesives & Sealants: For adhesives and sealants, documentation including printed statement of VOC content and chemical components.

1.07 QUALITY ASSURANCE

A. Membrane Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

C. Sustainability and LEED Standards Certification:
   1. Regional manufactured products with percentage by weight.
   2. Recycled content calculated as 1/2 preconsumer + postconsumer.
   3. VOC content limitations defined in Section 018114, "Volatile Organic Compound (VOC) Limits For Adhesives, Sealants, Paints, and Coatings."

1.08 FIELD CONDITIONS

A. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application and until liquid or mastic accessories have cured.

1.09 WARRANTY

A. See Section 01 77 00 - Closeout Procedures, for additional warranty requirements.

B. Contractor shall correct defective Work within a five year period after Date of Substantial Completion; remove and replace materials concealing waterproofing at no extra cost to Owner.

C. Provide five year manufacturer warranty for waterproofing failing to resist penetration of water, except where such failures are the result of structural failures of building. Hairline cracking of concrete due to temperature change or shrinkage is not considered a structural failure.

PART 2 PRODUCTS

2.01 WATERPROOFING APPLICATIONS

A. Self-Adhered Modified Bituminous Sheet Membrane:
   1. Location: Below grade walls adjacent to occupied spaces.
   2. Cover with protection board.

2.02 MEMBRANE MATERIALS

A. Self-Adhered Modified Bituminous Sheet Membrane:
   1. Thickness: 60 mil, 0.060 inch, minimum.
   2. Sheet Width: 36 inch, minimum.
   3. Tensile Strength:
      a. Film: 5000 pounds per square inch, minimum, measured according to ASTM D882 and at grip-separation rate of 2 inches per minute.
      b. Membrane: 325 pounds per square inch, minimum, measured according to ASTM D412 Method A, using die C and at spindle-separation rate of 2 inches per minute.
   4. Elongation at Break: 300 percent, minimum, measured according to ASTM D412.
   5. Water Vapor Permeance: 0.05 perm, maximum, measured in accordance with ASTM E96/E96M.
   6. Low Temperature Flexibility: Unaffected when tested according to ASTM D1970/D1970M at minus 20 degrees F, 180 degree bend on 1 inch mandrel.
   7. Peel Strength: 7 pounds per inch, minimum, when tested according to ASTM D903.
   8. Lap Adhesion Strength: 5 pounds per inch, minimum, when tested according to ASTM D1876.
   9. Puncture Resistance: 50 pounds, minimum, measured in accordance with ASTM E154/E154M.
   10. Water Absorption: 0.1 percent increase in weight, maximum, measured in accordance with ASTM D570, 24 hour immersion.
   11. Hydrostatic Resistance: Resists the weight of 200 feet when tested according to ASTM D5385/D5385M.
   12. Adhesives, Sealants, Tapes, and Accessories: As recommended by membrane manufacturer.
   13. Manufacturers:

a. Carlisle Coatings & Waterproofing Inc; MiraDRI 860/861: www.carlisleccw.com/#sle.
b. GCP Applied Technologies; Bituthene: www.gcpat.com.
c. Henry Company; Blueskin WP 200: www.henry.com/#sle.
d. Substitutions: See Section 01 60 00 - Product Requirements.

B. Self-Adhered HDPE Sheet Membrane: Recommended by manufacturer for placement below concrete slabs and on outside face of below grade walls before placement of concrete.
1. Sheet Thickness: 46 mil (0.046 inch), minimum.
2. Low Temperature Flexibility: Unaffected when tested according to ASTM D1970/D1970M at minus 20 degrees F, 180 degree bend on 1 inch mandrel.
3. Hydrostatic Resistance: Resists the weight of 231 feet when tested according to ASTM D5385/D5385M.
4. Elongation at Break: 500 percent, minimum, measured according to ASTM D412.
5. Tensile Strength, Film: 3,500 pounds per square inch, minimum, measured according to ASTM D412.
6. Lap Peel Adhesion: 5 pounds per inch, minimum, when tested according to ASTM D1876.
7. Water Vapor Permeance: 0.01 perm, maximum, measured in accordance with ASTM E96/E96M.
8. Bond to Concrete: 5 pounds per inch, minimum, per ASTM D903.
9. Lateral Water Migration Resistance: Resists the weight of 231 feet when tested according to ASTM D5385/D5385M.
10. Adhesives, Sealants, Tapes, and Accessories: As recommended by membrane manufacturer.
11. Manufacturers:
a. GCP Applied Technologies; Preprufe 300R: www.gcpat.com/#sle.
b. W.R. Meadows; PRECON: www.wrmeadows.com..
c. Substitutions: See Section 01 60 00 - Product Requirements.

C. Seaming Materials: As recommended by membrane manufacturer.

D. Membrane Sealant: As recommended by membrane manufacturer.

2.03 ACCESSORIES

A. Sealant for Cracks and Joints In Substrates: Resilient elastomeric joint sealant compatible with substrates and waterproofing materials.

B. Protection Board: Provide type capable of preventing damage to waterproofing due to backfilling and construction traffic.

C. Drainage Panel: Drainage layer with geotextile filter fabric on earth side.
1. Composition: Dimpled polystyrene core; polypropylene filter fabric.
2. Products:
a. Epro Services, Inc; ECODRAIN-MS: www.eproserv.com/#sle.
b. Mar-flex Waterproofing & Building Products; ArmorDrain 150: www.mar-flex.com/#sle.
c. Mar-flex Waterproofing & Building Products; ArmorDrain 400 Protection/Drainage Board: www.mar-flex.com/#sle.

D. Flexible Flashings: Type recommended by membrane manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions are acceptable prior to starting this work.

B. Verify substrate surfaces are durable; free of matter detrimental to adhesion or application of waterproofing system.

C. Verify items that penetrate surfaces to receive waterproofing are securely installed.

3.02 PREPARATION

A. Protect adjacent surfaces from damage not designated to receive waterproofing.

B. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions; vacuum substrate clean.

C. Do not apply waterproofing to surfaces unacceptable to membrane manufacturer.

D. Fill non-moving joints and cracks with a filler compatible with waterproofing materials.

E. Seal moving cracks with sealant and non-rigid filler, using procedures recommended by sealant and waterproofing manufacturers.

F. Prepare building expansion joints at locations as indicated on drawings.

G. Apply surface conditioner at a rate recommended by manufacturer, and protect conditioner from rain or frost until dry.

3.03 INSTALLATION - MEMBRANE

A. Install membrane waterproofing in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.

B. Roll out membrane, and minimize wrinkles and bubbles.

C. Self-Adhering Membrane: Remove release paper layer, and roll out onto substrate with a mechanical roller to provide full contact bond.

D. Overlap edges and ends, minimum 3 inches, seal permanently waterproof by method recommended by manufacturer, and apply uniform bead of sealant to joint edge.

E. Reinforce membrane with multiple thickness of membrane material over joints, whether joints are static or dynamic.

F. Weather lap joints on sloped substrate in direction of drainage, and seal joints and seams.

G. Flexible Flashings: Seal items watertight that penetrate through waterproofing membrane with flexible flashings.

H. Seal membrane and flashings to adjoining surfaces.

3.04 INSTALLATION - DRAINAGE PANEL AND PROTECTION BOARD

A. Place drainage panel directly against membrane, butt joints, place to encourage drainage downward. Scribe and cut boards around projections, penetrations, and interruptions.

B. Place protection board directly against drainage panel; butt joints. Scribe and cut boards around projections, penetrations, and interruptions.

C. Adhere protection board to substrate with compatible adhesive.

3.05 PROTECTION

A. Do not permit traffic over unprotected or uncovered membrane.

END OF SECTION

SECTION 07 21 00
THERMAL INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Board insulation at perimeter foundation wall and underside of floor slabs.

B. Batt insulation in exterior wall construction.

C. Acoustical insulation in interior acoustically rated partitions.

D. Fire safing insulation at fire partitions.

E. Spray insulation at cavity wall construction.

F. Spray insulation at inside of existing masonry exterior wall construction.

G. Low-rise spray insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

1.02 RELATED REQUIREMENTS

A. Section 07 26 40 - Spray Polyurethane Foam Insulating Air Barrier

B. Section 07 53 00 - Elastomeric Membrane Roofing: Insulation specified as part of roofing system.

C. Section 07 84 00 - Firestopping: Insulation as part of fire-rated through-penetration assemblies.

D. Section 09 21 16 - Gypsum Board Assemblies: Acoustic insulation inside walls and partitions.

1.03 REFERENCE STANDARDS

A. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013.

B. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2016.

C. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014.

D. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2012.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.

1.04 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

C. ABAA Field Quality Control Submittals: Submit third-party reports of testing and inspection required by ABAA QAP.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

F. ABAA Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.

G. ABAA Installer Qualification: Submit documentation of current contractor accreditation and current installer certification. Keep copies of contractor accreditation and installer certification on site during and after installation. Present on-site documentation upon request.

1.05 QUALITY ASSURANCE

A. Air Barrier Association of America (ABAA) Quality Assurance Program (QAP); www.airbarrier.org/#sle:
   1. Installer Qualification: Use accredited contractor, certified installers, evaluated materials, and third-party field quality control audit.
   2. Manufacturer Qualification: Use evaluated materials from a single manufacturer regularly engaged in air barrier material manufacture. Use secondary materials approved in writing by primary material manufacturer.

1.06 FIELD CONDITIONS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.01 INSULATION TYPE SCHEDULE:

Type 1	Batt/blanket insulation - unfaced
Type 2	Batt/blanket insulation with vapor barrier (NOT USED)
Type 3	Perimeter Insulation - rigid
Type 4	Cavity wall insulation - rigid (NOT USED)
Type 4A	Cavity wall insulation - mineral fiber (NOT USED)
Type 5	Acoustical insulation
Type 6	Fire safing insulation
Type 7	Spray polyurethane foam insulation

2.02 APPLICATIONS

A. Insulation at Perimeter of Foundation: Type 3 - Extruded polystyrene board.

B. Insulation Inside Masonry Cavity Walls: Type 7 - Spray polyurethane foam, refer to Section 07 26 40.

C. Insulation Over Metal Stud Framed Walls, Continuous: Type 7 - Spray polyurethane foam, refer to Section 07 26 40.

D. Insulation on Inside of Concrete and Masonry Exterior Walls: Type 7 - Spray polyurethane foam, refer to Section 07 26 40 board.

E. Insulation Over Roof Deck: Polyisocyanurate board. Refer to Section 07 53 00.

F. Insulation in sound rated partitions: Type 5

G. Insulation at voids and penetration of fire separations and smoke walls: Type 6

H. Insulation at rated CMU walls terminating at deck above: Type 6

2.03 FOAM BOARD INSULATION MATERIALS

A. Type 3 and Type 4 - Extruded Polystyrene Board Insulation: Extruded polystyrene board; ASTM C578; with either natural skin or cut cell surfaces, and the following characteristics:
   1. Type and Compressive Resistance: Type VI, 40 psi (276 kPa), minimum.
   2. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
   3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
   4. R-value; 1 inch of material at 72 degrees F: 5, minimum.
   5. Board Edges: Square.
   6. Water Absorption, Maximum: 0.3 percent, by volume.
   7. Manufacturers:
      a. Dow Chemical Company; STYROFOAM HIGHLOAD 40: www.dowbuildingsolutions.com/#sle.
      b. Owens Corning Corporation; FOAMULAR Extruded Polystyrene (XPS) Insulation: www.ocbuildingspec.com/#sle.
      c. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 FIBERBOARD INSULATION MATERIALS

A. Type 6 - Mineral Fiberboard Insulation: Rigid or semi-rigid mineral fiber, ASTM C612 or ASTM C553; unfaced flame spread index of 0 (zero) when tested in accordance with ASTM E84.
   1. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
   2. Manufacturers:
      a. ROCKWOOL (ROXUL, Inc); CURTAINROCK 80: www.rockwool.com/#sle.
      b. ROCKWOOL (ROXUL, Inc); CURTAINROCK 40: www.rockwool.com/#sle.
      c. ROCKWOOL (ROXUL, Inc); ROXUL SAFE 65: www.rockwool.com/#sle.

2.05 BATT INSULATION MATERIALS

A. Type 1 and Type 5 - Mineral Fiber Batt Insulation: Flexible or semi-rigid preformed batt or blanket, complying with ASTM C665; friction fit; unfaced flame spread index of 0 (zero) when tested in accordance with ASTM E84.
   1. Smoke Developed Index: 0 (zero), when tested in accordance with ASTM E84.
   2. Manufacturers:
      a. Johns Manville; MinWool Sound Attenuation Fire Batts: www.jm.com/#sle.
      b. Thermafiber, Inc; SAFB: www.thermafiber.com/#sle.
      c. ROCKWOOL (ROXUL, Inc); AFB™: www.rockwool.com/#sle.

2.06 LOW EXPANSION SPRAY INSULATION

A. Low Expansion Spray Insulation: Minimal expansion, low pressure polyurethane foam to fill voids around doors and windows.
   1. Manufacturers:
      a. DuPont; Window & Door Foam
      b. DOW; Great Stuff Pro Window & Door Insulating Foam Sealant
      c. Substitutions: See Section 01 60 00 - Product Requirements.

2.07 ACCESSORIES

A. Insulation Fasteners: Impaling clip of nylon with washer retainer and clips, to be adhered to surface to receive insulation, length to suit insulation thickness and substrate, capable of securely and rigidly fastening insulation in place.

B. Adhesive: Type recommended by insulation manufacturer for application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.

B. Verify substrate surfaces are flat, free of irregularities or materials or substances that may impede adhesive bond.

3.02 BOARD INSTALLATION AT FOUNDATION PERIMETER

A. Install boards vertically and/or horizontally on foundation perimeter.
   1. Place boards to maximize adhesive contact.
   2. Install in running bond pattern.
   3. Butt edges and ends tightly to adjacent boards and to protrusions.

B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.03 BOARD INSTALLATION UNDER CONCRETE SLABS

A. Place insulation under slabs on grade after base for slab has been compacted.

B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

C. Prevent insulation from being displaced or damaged while placing vapor retarder and placing slab.

3.04 BATT INSTALLATION

A. Install insulation in accordance with manufacturer's instructions.

B. Install in exterior wall and roof spaces without gaps or voids. Do not compress insulation.

C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

3.05 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Coordination of Air Barrier Association of America (ABAA) Tests and Inspections:
   1. Provide testing and inspection required by ABAA Quality Assurance Program (QAP).
   2. Notify in ABAA writing of schedule for air barrier work, and allow adequate time for testing and inspection.
   3. Cooperate with ABAA testing agency.
   4. Allow access to air barrier work areas and staging.
   5. Do not cover air barrier work until tested, inspected, and accepted.

3.06 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

SECTION 07 21 29
SPRAYED INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cellulose insulation applied to underside of structure.

1.02 REFERENCE STANDARDS

A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2015.

B. ASTM C739 - Standard Specification for Cellulosic Fiber Loose-Fill Thermal Insulation; 2011.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.

1.03 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Product Data: Provide data on materials, describing insulation properties.

C. Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

D. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.

E. Submit manufacturer's written certification that product contains no asbestos, fiberglass or other man-made mineral fibers.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section and approved by manufacturer.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver in original, unopened containers bearing name of manufacturer, product identification and reference to U.L. testing.

B. Store materials dry, off ground, and under cover.

C. Protect liquid adhesive from freezing.

1.06 FIELD CONDITIONS

A. Maintain acceptable ambient and substrate surface temperatures prior to, during, and after installation of primer and insulation materials and overcoat.

B. Clips, hangers, supports, sleeves and other attachments to spray bases are to be placed by other trades prior to the application of sprayed insulation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Cellulose Fiber:

1. International Cellulose Corp; K-13 Spray-On-Systems: www.spray-on.com.
2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

A. Cellulose Fiber Insulation: ASTM C739; treated cellulose fiber, color shall be from manufacturer's standard range.
   1. Thickness: 2 inches, unless otherwise noted.
   2. Material to have been tested in accordance with ASTM E 1042. Testing laboratory must be NVLAP accredited.
   3. Produce shall meet or exceed the following requirements:
      a. Bond strength shall be greater than 100 psf per ASTM E 736.
      b. Product shall be Class 1 Class A per ASTM E 84/ UL 723.
      c. Non-corrosive per ASTM C 739.
      d. Bond Deflection per ASTM E 759: 6” Deflection in 10’ Span - No Spalling or Delamination.
      e. R-Value to be 3.75 per inch per ASTM C518.
      f. Comply with IBC 803.3/2009 IBC 803.10 stability requirements for interior finishes.
      g. Meet ASTM C 1149
      h. Cannot contain any added Urea-Formaldehyde Resins.

2.03 ACCESSORIES

A. Primer: As required by insulation manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are clean, dry, and free of matter that may inhibit adhesion.

B. Verify that ceiling hangers and supporting clips have been are installed correctly.

C. Verify other work on and within spaces to be insulated is complete prior to application.

3.02 PREPARATION

A. Mask and protect adjacent surfaces from overspray or damage.

B. Apply primer in accordance with manufacturer's instructions.

3.03 INSTALLATION

A. Install insulation in accordance with manufacturer's instructions.

B. Install insulation to a uniform monolithic density without voids.

C. Install to a minimum cured thickness of 2 inches.

3.04 PROTECTION

A. Do not permit subsequent construction work to disturb applied insulation.

END OF SECTION

SECTION 07 25 00
WEATHER BARRIERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water-Resistive Barrier: Under exterior wall cladding, over sheathing or other substrate; not air tight or vapor retardant.

B. Vapor Retarders: Materials to make exterior walls, joints between exterior walls and roof, joints around frames of openings in exterior walls, and roof assemblies water vapor resistant and air tight.

C. Air Barriers: Materials that form a system to stop passage of air through exterior walls, joints between exterior walls and roof, joints around frames of openings in exterior walls, and roof assemblies.

1.02 RELATED REQUIREMENTS

A. Section 07 26 17 - Underslab Vapor Barrier

B. Section 07 26 40 - Spray Polyurethane Foam Insulating Air Barrier: Insulation and air barrier in exterior walls.

C. Section 07 62 00 - Sheet Metal Flashing and Trim: Metal flashings installed in conjunction with weather barriers.

1.03 DEFINITIONS

A. Weather Barrier: Assemblies that form either water-resistive barriers, air barriers, or vapor retarders.

B. Air Barrier: Air tight barrier made of material that is relatively air impermeable but water vapor permeable, both to the degree specified, with sealed seams and with sealed joints to adjacent surfaces. Note: For the purposes of this specification, vapor impermeable air barriers are classified as vapor retarders.

C. Vapor Retarder: Air tight barrier made of material that is relatively water vapor impermeable, to the degree specified, with sealed seams and with sealed joints to adjacent surfaces.

1. Water Vapor Permeance: For purposes of conversion, 57.2 ng/(Pa s sq m) = 1 perm.

D. Water-Resistive Barrier: Water-shedding barrier made of material that is moisture resistant, to the degree specified, intended to be installed to shed water without sealed seams.

1.04 REFERENCE STANDARDS

A. AATCC Test Method 127 - Water Resistance: Hydrostatic Pressure Test; 2014.

B. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2006a (Reapproved 2015a).

C. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2015a.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.

E. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.

F. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials; 2013.

G. ICC-ES AC38 - Acceptance Criteria for Water-Resistive Barriers; ICC Evaluation Service, Inc; 2013.

H. ICC-ES AC380 - Acceptance Criteria for Termite Physical Barrier Systems; 2014 (editorially revised 2017).

1.05 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Product Data: Provide data on material characteristics.

C. ABAA Field Quality Control Submittals: Submit third-party reports of testing and inspection required by ABAA QAP.

D. Manufacturer's Installation Instructions: Indicate preparation, installation methods, and storage and handling criteria.

E. ABAA Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.

F. ABAA Installer Qualification: Submit documentation of current contractor accreditation and current installer certification; keep copies of each contractor accreditation and installer certification on site during and after installation, and present on-site documentation upon request.

1.06 QUALITY ASSURANCE

A. Air Barrier Association of America (ABAA) Quality Assurance Program (QAP); www.airbarrier.org/#sle:

1. Installer Qualification: Use accredited contractor, certified installers, evaluated materials, and third-party field quality control audit.
2. Manufacturer Qualification: Use evaluated materials from a single manufacturer regularly engaged in air barrier material manufacture, and use secondary materials approved in writing by primary material manufacturer.

1.07 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by the materials manufacturers before, during and after installation.

PART 2 PRODUCTS

2.01 WEATHER BARRIER ASSEMBLIES

A. Water-Resistive Barrier: Provide on exterior walls under exterior cladding.

1. Use water-resistive barrier sheet, mechanically fastened unless otherwise indicated.

B. Air Barrier:

1. On outside surface of gypsum sheathing WHERE SPRAY POLYURETHANE FOAM INSULATING AIR BARRIER IS NOT INDICATED. Use air barrier sheet, self-adhesive type.

2.02 WATER-RESISTIVE BARRIER MATERIALS (NEITHER AIR BARRIER OR VAPOR RETARDER)

A. Weather-Resistive Barrier, Composite: Tear-resistant polyester sheet with UV-resistant acrylic coating.

1. Air Permeance: 0.178 cubic feet per minute per square foot, maximum, when tested in accordance with ASTM E2178.
2. Water Vapor Permeance: 200 perms, minimum, when tested in accordance with ASTM E96/E96M Procedure A (desiccant procedure).
3. Ultraviolet and Weathering Resistance: Approved in writing by manufacturer for up to 210 days of weather exposure.
4. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less (Class A), when tested in accordance with ASTM E84.
5. Water Resistance: Comply with applicable water-resistive requirements of ICC-ES AC38.
6. Manufacturers:
   a. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 AIR BARRIER MATERIALS (WATER VAPOR PERMEABLE AND WATER-RESISTIVE)

A. Air Barrier Sheet, Self-Adhered:
   1. Air Permeance: 0.004 cubic feet per minute per square foot, maximum, when tested in accordance with ASTM E2178.
   2. Water Vapor Permeance: 10 perms, minimum, when tested in accordance with ASTM E96/E96M Procedure A (desiccant procedure).
   3. Ultraviolet (UV) and Weathering Resistance: Approved in writing by manufacturer for up to 90 days of weather exposure.
   4. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less (Class A), when tested in accordance with ASTM E84.
   5. Manufacturers:
      a. Henry Company; Blueskin VP160: www.henry.com/#sle.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

B. Air Barrier, Fluid Applied: Vapor permeable, elastomeric waterproofing.
   1. Air Barrier Membrane:
      a. Material: Water-based acrylic.
      b. Air Permeance: 0.004 cubic feet per minute per square foot, maximum, when tested in accordance with ASTM E2178.
      c. Water Vapor Permeance: 5 perms, minimum, when tested in accordance with ASTM E96/E96M, Procedure B.
      d. Ultraviolet (UV) and Weathering Resistance: Approved in writing by manufacturer for up to three months of weather exposure.
      e. Elongation: 300 percent, minimum, when tested in accordance with ASTM D412.
      f. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.
      g. VOC Content: 100 g per L or less.
      h. Sealants, Tapes and Accessories: As recommended by coating manufacturer.
      i. Manufacturers:
         1) Henry Company; Air-Bloc 33MR: www.henry.com/#sle.
         2) Parex USA, Inc; Parex USA WeatherSeal Trowel-on (without gauging aggregate): www.parexusa.com/#sle.
         3) Substitutions: See Section 01 60 00 - Product Requirements.

2.04 ACCESSORIES

A. Sealants, Tapes, and Accessories for Sealing Weather Barrier and Sealing Weather Barrier to Adjacent Substrates: As specified or as recommended by weather barrier manufacturer.

B. Flexible Flashing: Self-adhesive sheet flashing complying with ASTM D1970/D1970M, except slip resistance requirement is waived if not installed on a roof.

C. Pre-formed Transition Membrane: Semi-rigid silicone or polyester composition, tapered edges, tear resistant.

D. Thinners and Cleaners: As recommended by material manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and conditions are ready to accept the work of this section.

3.02 PREPARATION

A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

B. Clean and prime substrate surfaces to receive adhesives in accordance with manufacturer's instructions.

3.03 INSTALLATION

A. Install materials in accordance with manufacturer's instructions.

B. Water-Resistive Barriers: Install continuous barrier over surfaces indicated, with sheets lapped to shed water but with seams not sealed.

C. Air Barriers: Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.

D. Vapor Retarders: Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.

E. Apply sealants and adhesives within recommended application temperature ranges. Consult manufacturer if temperature is out of this range.

F. Mechanically Fastened Sheets - On Exterior:
   1. Install sheets shingle-fashion to shed water, with seams generally horizontal.
   2. Overlap seams as recommended by manufacturer but at least 6 inches.
   3. Overlap at outside and inside corners as recommended by manufacturer but at least 12 inches.
   4. Attach to framed construction with fasteners extending through sheathing into framing. Space fasteners at 12 to 18 inches on center along each framing member supporting sheathing.
   5. For applications specified to be air tight, seal seams, laps, penetrations, tears, and cuts with self-adhesive tape; use only large-headed, gasketed fasteners recommended by the manufacturer.
   6. Install air barrier and vapor retarder UNDER jamb flashings.
   7. Install head flashings under weather barrier.
   8. At openings to be filled with frames having nailing flanges, wrap excess sheet into opening; at head, seal sheet over flange and flashing.

G. Self-Adhered Sheets:

1. Prepare substrate in manner recommended by sheet manufacturer; fill and tape joints in substrate and between dissimilar materials.
2. Lap sheets shingle-fashion to shed water and seal laps air tight.
3. Once sheets are in place, press firmly into substrate with resilient hand roller; ensure that laps are firmly adhered with no gaps or fishmouths.
4. Use same material, or other material approved by sheet manufacturer for the purpose, to seal to adjacent construction and as flashing.
5. At wide joints, provide extra flexible membrane allowing joint movement.

H. Coatings:
1. Prepare substrate in manner recommended by coating manufacturer; treat joints in substrate and between dissimilar materials as recommended by manufacturer.
2. Where exterior masonry veneer is to be installed, install masonry anchors before installing weather barrier over masonry; seal around anchors air tight.
3. Mastic Coating: Install by trowel or roller to minimum thickness of 1/4 inch; use sheet seal to join to adjacent construction, seal air tight with sealant.
4. Use flashing to seal to adjacent construction and to bridge joints.

I. Openings and Penetrations in Exterior Weather Barriers:
1. Install flashing over sills, covering entire sill frame member, extending at least 5 inches onto weather barrier and at least 6 inches up jambs; mechanically fasten stretched edges.
2. At openings to be filled with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with sealing tape at least 4 inches wide; do not seal sill flange.
3. At openings to be filled with non-flanged frames, seal weather barrier to each side of opening framing, using flashing at least 9 inches wide, covering entire depth of framing.
4. At head of openings, install flashing under weather barrier extending at least 2 inches beyond face of jambs; seal weather barrier to flashing.
5. At interior face of openings, seal gap between window/door frame and rough framing, using joint sealant over backer rod.
6. Service and Other Penetrations: Form flashing around penetrating item and seal to weather barrier surface.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Coordination of ABAA Tests and Inspections:
1. Provide testing and inspection required by ABAA QAP.
2. Notify in ABAA writing of schedule for air barrier work. Allow adequate time for testing and inspection.
3. Cooperate with ABAA testing agency.
4. Allow access to air barrier work areas and staging.
5. Do not cover air barrier work until tested, inspected, and accepted.

C. Do not cover installed weather barriers until required inspections have been completed.

D. Obtain approval of installation procedures by the weather barrier manufacturer based on a mock-up installed in place, prior to proceeding with remainder of installation.

3.05 PROTECTION

A. Do not leave materials exposed to weather longer than recommended by manufacturer.

END OF SECTION

SECTION 07 26 17
UNDER-SLAB VAPOR BARRIER/RETARDER

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Vapor Barrier, seam tape, mastic, pipe boots, detail strip for installation under concrete slabs.

1.02 RELATED SECTIONS

A. Section 03300 Cast-in-place Structural Concrete

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM)
   1. ASTM E 1745-97(2004) Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs
   2. ASTM E 154-99(2005) Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs
   3. ASTM E 96-05 Standard Test Methods for Water Vapor Transmission of Materials
   4. ASTM E 1643-98(2005) Standard Practice for Installation of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs

1.04 SUBMITTALS

A. Quality Control / Assurance
   1. Independent laboratory test results showing compliance with ASTM & ACI Standards.
   2. Manufacturer's samples, literature
   3. Manufacturer's installation instructions for placement, seaming and pipe boot installation

PART 2 - PRODUCTS

2.01 MATERIALS

A. Vapor Barrier
   1. Vapor Barrier must have the following qualities
      a. Perm rating less than or equal to 0.01 perms (grains/(ft2 *hr * in. Hg)) after conditioning as tested by:
         1) ASTM E 96
         2) ASTM E 1745 Class A (Plastics), paragraph 7.1.2-5.

B. Vapor Barrier Products
   1. Stego Wrap (15 mil) Vapor Barrier by STEGO INDUSTRIES LLC, San Clemente, CA (877) 464-7834 www.stegoindustries.com
   2. Griffolyn 15 mil Green Vapor Barrier by Reef Industries, Inc.
   3. VaporBlock 15 by Raven Industries, Inc.

C. ACCESSORIES
   1. Seam Tape
      a. Tape must have the following qualities:
         1) Water Vapor Transmission Rate ASTM E 96: 0.3 perms or lower
   2. Vapor Proofing Mastic
      a. Mastic must have the following qualities:
         1) Water Vapor Transmission Rate ASTM E 96: 0.3 perms or lower

3. Pipe Boots
   a. Provide manufacturer's supplied pipe boot system or construct pipe boots from vapor barrier material, pressure sensitive tape and/or mastic per manufacturer's instructions.

PART 3 - EXECUTION

3.01 PREPARATION

A. Ensure that subsoil is approved by architect or geotechnical firm
   1. Level and tamp or roll aggregate, sand or tamped earth base.

3.02 INSTALLATION

A. Install Vapor Barrier/Retarder:
   1. Installation shall be in accordance with manufacturer's instructions and ASTM E 1643.
   2. Unroll Vapor Barrier/Retarder with the longest dimension parallel with the direction of the pour.
   3. Lap Vapor Barrier/Retarder over footings and seal to foundation walls.
   4. Overlap joints 6 inches and seal with manufacturer's tape.
   5. Seal all penetrations (including pipes) per manufacturer's instructions.
   6. No penetration of the Vapor Barrier/Retarder is allowed except for reinforcing steel and permanent utilities.
   7. Repair damaged areas by cutting patches of Vapor Barrier/Retarder, overlapping damaged area 6 inches and taping all four sides with tape.

END OF SECTION

SECTION 07 26 40
SPRAY POLYURETHANE FOAM INSULATING AIR BARRIER

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Materials and installation to bridge and seal the following air leakage pathways and gaps:
   1. Connections of the walls to the roof air barrier.
   2. Connections of the walls to the foundations.
   3. Openings and penetrations of window frames.
   4. Barrier envelope systems.
   5. Door frames.
   6. Piping, conduit, duct and similar penetrations
   7. Masonry ties, screws, bolts and similar penetrations.
   8. All other air leakage pathways in the building envelope.

1.02 PRODUCTS INSTALLED BUT NOT SUPPLIED UNDER THIS SECTION

A. Sheet metal flashings are specified under Section 07 62 00.

1.03 RELATED SECTIONS

A. Section 04 20 00 - Unit Masonry:

B. Section 07 21 00 - Building Insulation.

C. Section 07 92 00 - Joint Sealants: Joint sealant materials and installation.

D. Section 08 11 13- Door frames.

E. Section 08 51 13 - Aluminum Windows

F. Section 08 43 13 Aluminum storefronts and entrances

G. Section 08 44 13 - Glazed Aluminum Curtain Walls

1.04 PERFORMANCE REQUIREMENTS

A. Provide air/vapor barrier system constructed to perform as follows:
   1. A continuous air/vapor barrier system.
   2. Building thermal insulation.

B. System shall accommodate movements of building materials by providing expansion and control joints as required, with accessory air seal materials at such locations, changes in substrate and perimeter conditions.

C. Maximum Permissible Air Leakage Rates cfm/sf @ 0.3" w.g. (l/s.m2 @ 75 Pa)
   1. 0.02 (0.1)

1.05 SUBMITTALS

A. Provide submittals in accordance with Section 01 30 00.

B. Submit shop drawings showing locations and extent of air/vapor barrier and details of all typical conditions, intersections with other envelope systems and materials, membrane flashings and counter-flashings, and details showing how gaps in the construction will be bridged, how inside and outside corners are negotiated and how miscellaneous penetrations such as conduits, pipes electric boxes and the like are sealed.

C. Submit manufacturer's product data sheets for each type of material, including manufacturer's printed instructions for evaluating, preparing, and treating substrate, temperature and other limitations of installation conditions, technical data, and tested physical and performance properties.

D. Submit manufacturer's installation instructions.

E. Provide evidence of testing by an accredited laboratory confirming material has been tested and conforms to the requirements of ASTM E2178, Standard for Air Barrier Materials.

F. Certification by air/vapor barrier manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).

G. Certification of compatibility by air/vapor barrier manufacturer, listing all materials on the project that it connects to or that come in contact with it.

H. Submit two samples, 12 by 12 inch (300 by 300 mm) minimum size, of each air/vapor barrier material required for Project.

I. Submit test results of air permeability testing of primary air barrier material (ASTM E 2178-01).

J. For LEED requirements, provide evidence of a minimum 14.6% recycled content and minimum 2.8% rapidly-renewable content.

K. Provide evidence of testing by an accredited laboratory confirming material has been tested and conforms to the requirements of ASTM E2357, Standard Test Method for Determining Air Leakage of Air Barrier Assemblies: Pass.

L. Provide evidence of testing by an accredited laboratory confirming material has been tested and conforms to the requirements of NFPA 285: Pass.

M. Quality Assurance Program: Submit evidence of current accreditation and certification under the Air Barrier Association of America's (ABAA) Quality Assurance Program. Submit accreditation number of manufacturer and certification number of installers at time of submittal.

1.06 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Each worker who is installing air barriers must be either a Certified Applicator or an installer who is registered with ABAA
   2. Installers shall also be certified by ABAA/NECA (National Energy Conservation Association) and PSDI (Professional Skills Development Institute for energy conservation) and SPFA (Spray Polyurethane Foam Alliance as foam mechanics). Installers shall have their photo-identification certification cards in their possession and available on the project site, for inspection upon request.
   3. Provide products that comply with all state and local regulations controlling use of volatile organic compounds (VOCs).
   4. Preconstruction Meeting: Convene one week prior to commencing Work of this section, in accordance with Section 01 20 00 - Project Meetings.
   5. Cooperate and coordinate with the Owner's inspection and testing agency if required. Do not cover any installed air and vapor barrier unless it has been inspected, tested and approved per requirements.
   6. Protect people and materials from over-spray and contact with chemicals and gases.

1.07 FIELD QUALITY ASSURANCE

A. Implement the ABAA Quality Assurance Program requirements. Cooperate with ABAA inspectors and independent testing and inspection agencies engaged by the Owner. Do not cover air barrier until it has been inspected, tested, and accepted.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original packages with seals unbroken, labeled with manufacturer's name, product, date of manufacture, expiration date, and directions for storage.

B. Store materials in their original undamaged packages in a clean, dry, protected location and within temperature range required by air/vapor barrier manufacturer. Protect stored materials from direct sunlight.

C. Avoid spillage. Immediately notify Owner, Architect if spillage occurs and start clean up procedures.

D. Clean spills and leave area as it was prior to spill.

1.09 WASTE MANAGEMENT AND DISPOSAL

A. Place materials defined as hazardous or toxic waste in designated containers.

B. Ensure emptied containers are sealed and stored safely for disposal away from children.

1.10 PROJECT CONDITIONS

A. Environmental Conditions: Apply air/vapor barrier within range of ambient and substrate temperatures recommended by air/vapor barrier manufacturer. Do not apply air/vapor barrier to a damp or wet substrate, unless the manufacturer specifically permits that for the product.

1. Do not apply air/vapor barrier in snow, rain, fog, or mist.
2. Do not apply air/vapor barrier when the temperature of substrate surfaces and surrounding air temperatures are below those recommended by the manufacturer.
3. The product shall not be installed after the expiry date printed on the label of each container. The product has a shelf life of 6 months from the date of manufacture.

1.11 WARRANTY

A. System Warranty: Provide the manufacturer's three year system warranty, including the primary air/vapor barrier and installed accessory sealant and membrane materials which fail to achieve air tight and watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 - PRODUCTS

2.01 MATERIALS & MANUFACTURERS

A. Sprayed polyurethane foam material, when tested, shall meet the requirements of ULC S705.1-01 Standard for Thermal Insulation-Spray Applied Rigid Polyurethane Foam, Medium Density, Material- Specification.

B. A copy of an Evaluation Report (such as the CCMC Evaluation Report) or copies of the test reports from an accredited testing laboratory, for each physical property, indicating that the product meets the requirements of ULC S705.1-01 shall be made available upon request.

C. Material containers shall be labeled with the Evaluation Report number of the evaluation agency.

D. Design R-value as indicated in test report; minimum R6.9/inch.

E. Density as indicated in test report: minimum 1.7 pounds per cubic foot.

F. Smoke development as indicated in test report; less than 500 when tested under ULC S102.

G. Products that meet the preceding requirements:
   1. Basis-of-design product: Walltite closed cell spray foam polyurethane air/vapor barrier as manufactured by BASF (215-966-1168).

H. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of another manufacturer with approved submittal meeting the design criteria:
   1. Icynene: www.icynene.com

I. Substitutions: See Section 01 60 00 - Product Requirements
   1. For any product not identified as "Basis of Design", submit information as specified or substitutions.

2.02 AUXILIARY MATERIALS

A. Furnish auxiliary materials recommended by air/vapor barrier manufacturer for intended use and compatible with the air/vapor barrier.

B. Transition Membrane: Self-adhering, smooth surfaced SBS modified bitumen membrane, nominal 40 mil thickness, width as required, to detail all rough openings, changes in material substrates, and penetrations.
   1. Blueskin SA as manufactured by Henry Company Inc
   2. Butyl-based peel and stick membrane: Transition between air/vapor barrier membrane and TPO or EPDM membranes:
      a. Blueskin SA as manufactured by Henry Company Inc.
   3. Primer: Water based liquid primer for concrete, masonry, gypsum sheathing, wood, metal, and painted substrates;
      a. Aquatac as manufactured by Henry Company Inc.
   4. Mastic, Adhesives, and Tape: Liquid mastic and adhesives, and adhesive tapes approved by foamed in place air/vapor barrier manufacturer.
   5. Sheet Membrane Transition Strip Termination Sealant:
      a. BES 925 Sealant by Henry Company Inc.
   6. Sheet Membrane Sheet Membrane Air Barrier Perimeter Seal to Windows, Doors: Low modulus silicone sheet; provide manufacturer's standard system consisting of precured low-modulus silicone extrusion, in sizes to fit widths indicated, combined with a neutral-curing low modulus silicone sealant for bonding extrusions to substrates.
      a. Pecora Sil-Span.
      b. Dow 1-2-3 or equal.
   7. Provide sealants in accordance with Section 07 92 00 - Joint Sealants. Comply with ASTM C920 and ASTM C920 classifications for type, grade, class, and uses.
      a. Silicone Sealant: natural cure, low modulus, to seal sheet membrane flashing to polyethylene face of sheet rubberized-asphalt barrier and to seal between and to non-bituminous sheet systems.
         1) Acceptable materials:
            (a) Dow 790
            (b) Pecora 864
      b. SPF (Sprayed Polyurethane Foam) Sealant: Provide one- or two-component, foamed-in-place, polyurethane foam sealant with the following characteristics:

1) Density: 1.5 to 2.0 PCF.
2) Flame Spread (ASTM E162): 25 or less.
3) Initial R-Value (at 1 inch): Not less than 7.
4) Acceptable materials:
(a) Zerodraft Foam Sealant.
(b) Zerodraft Insulating Air Sealant
Zerodraft (Division of Canam Building Envelope Specialists Inc.), 125 Traders Blvd. E., Unit # 4, Mississauga, ON, L4Z 2H3 Tel. 1-877-272-2626

c. Substrate Cleaner: Non-corrosive compatible with adjacent materials.

C. Drainage Mat with Moisture Resistant Filter Fabric
1. Basis of Design: Stuc-O-Flex International, Inc.; Waterway 19mm
2. Filter Fabric shall meet minimum performance criteria outlined below:
a. Performance Testing:
1) Boat Test ASTM D-779-03:
2) H2O Vapor Transfer in 12 Minutes
3) 96 Hours No Water Passed Through Membrane
b. Water Vapor Transmission Test: ASTM E-96:
1) Perm Rating Exceeds 247
c. Hydrostatic Pressure Test - AATCC 127:
1) 10cm / 18 hours
d. Acceptance Criteria AC-38 / Water Resistive Barriers:
1) Passes section 4.2.2 Ponding Water Test
3. Description: WaterWay Rainscreen 19mm is a 3/4 inch / 19 mm randomly oriented geometrically patterned drainage and ventilation mat. It is designed to eliminate moisture and moisture vapor in masonry applications and other siding applications. It is produced from an extruded polymer matrix of tangled monofilaments. The monofilaments are heat welded at the junctions to form a resilient structure that spaces siding away from the inner sheathing. The product is especially useful in masonry where a clear cavity is desired. Uses include manufactured and natural stone, traditional and one coat stucco, EIFS, fiber-cement and wood based sidings, masonry, metal and other wall cladding materials.
a. Core Material: Extruded Polymer Matrix.
b. Fabric Material: Non-Woven Geo-composite Fabric
c. Width: 48 "
d. Length: 50' (15.2m).
e. Thickness: 0.75" (19.0mm).
f. Weight: 32 lb/roll
g. Footage per Roll: 180 sq. ft.
4. Location: Inside face of masonry exterior walls as indicated on drawings.

D. Intumescent Coating
1. International Fireproof Technology Inc. DC-315: Water based, intumescent paint, conforming to the following:
a. Product shall pass full scale fire resistance test with spray foam insulating air barrier in accordance with NFPA 286: 24 wet mils (thermal barrier)
b. Finish: Flat, grey color

c. VOC Content: 47g/L
d. Volumne Solids: 67%
e. Flash Point: none
f. Mechanism of cure: coalescence
g. Reducer/cleaner: water

2.03 EQUIPMENT

A. The equipment used to spray the polyurethane foam material shall be in accordance with ULC S705.2-02 and the equipment manufacturer's recommendations for specific type of application.

B. Equipment settings are to be recorded on the Daily Work Record as required by the ULC S705.2-02 Installation standard.

C. Each proportioner unit to supply only one spray gun.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions under which air/vapor barrier systems will be applied, with Installer present, for compliance with requirements. Verify that surfaces and conditions are suitable prior to commencing work of this section. Do not proceed with installation until unsatisfactory conditions have been corrected.
   1. Ensure that:
      a. surfaces are sound, dry, even, and free of oil, grease, dirt, excess mortar or other contaminants
      b. concrete surfaces are cured and dry, smooth without large voids, spalled areas or sharp protrusions.
      c. masonry joints are flush and completely filled with mortar, and all excess mortar sitting on masonry ties has been removed.
      d. Verify substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D4263.
      e. Notify Architect in writing of anticipated problems using air/vapor barrier over substrate.

3.02 INSTALLATION

A. Install Drainage Mat:
   1. For horizontal application, work from bottom to top. For vertical applications work from a corner wrap the building completely, butting tightly to all door and window casings, stopping at all wall ends. Install Drainage mat so that it lies flat against the wall.
   2. If wall is designed as a venting wall, ends should be terminated at a furring strip of matching thickness to prevent air movement to adjoining wall.
   3. At all window and door openings, cut tight to vertical part of window, door casings.
   4. Take care not to cut or damage waterproofing and weather barrier.
   5. Maximum exposure of WaterWay Rainscreen shall not exceed 30 days, prior to cladding installation.

3.03 SURFACE PREPARATION

A. Clean, prepare, and treat substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air/vapor barrier application.

B. Prime ICBP metal substrates with conditioning primer when installing modified asphalt membrane transition membranes.

C. Prepare, treat, and seal vertical and horizontal surfaces at terminations and penetrations through air/vapor barrier and at protrusions according to air/vapor barrier manufacturer's written instructions.
   1. Verify that surfaces and conditions are suitable to accept work as outlined in this section.
   2. Commencement of work outlined in this section shall be deemed as acceptance of existing work and conditions.
   3. Examine joints before sealing to ensure configurations, surfaces and widths are suitable for spray polyurethane foam. Report in writing all defects stating the locations of joints deemed unacceptable for the application of the spray polyurethane foam.

3.04 PREPARATION

A. Protection:
   1. Mask and cover adjacent areas to protect from over spray.
   2. Ensure any required foam stop or back up material are in place to prevent over spray and achieve complete seal.
   3. Seal off existing ventilation equipment. Install temporary ducting and fans to ensure exhaust fumes. Provide for make-up air.
   4. Erect barriers, isolate area and post warning signs to advise non-protected personnel to avoid the spray area.
   5. Surface Preparation
      a. Surfaces to receive foam insulation shall be clean, dry and properly fastened to ensure adhesion of the polyurethane foam to the substrate.
      b. Ensure that all work by other trades that may penetrate through the air barrier system is in place and complete.
      c. Ensure that surface preparation and any primers required conform to the manufacturer's instructions.
      d. Prepare surfaces by brushing, scrubbing. Scraping, or grinding to remove loose mortar, dust, oil, grease, oxidation, mill scale and other contaminants which will affect adhesion and integrity of the spray polyurethane foam. Wipe down metal surfaces to remove release agents or other non-compatible coatings, using clean sponges or rags soaked in a solvent compatible with the spray polyurethane foam. Ensure surfaces are dry before proceeding.
      e. Install transition membranes around and into all rough openings, to all materials penetrating the exterior wall to all applicable surfaces and ensure proper adhesion of the transition membranes to the substrate, capable of having spray polyurethane foam insulation.
      f. Install counter-flashings:
         1) Metal: Mechanically fasten metal counter-flashings with screws at 8” (200 mm) o.c.
         2) Membrane: Cut into and uncover only 3” of siliconized release paper along one edge of the counter-flashing membrane. Adhere membrane flashing to the pre-primed substrate a minimum of 3” and roll firmly in place.
      g. Ensure veneer anchors are in place.

3.05 APPLICATION

A. Spray-application of polyurethane foam shall be installed in accordance with ULC S705.2-02 and the manufacturer's instructions.

B. Apply only when surfaces and environmental conditions are within limits prescribed by the material manufacturer and the ULC S705.2 Installation standard.

C. Apply in consecutive passes as recommended by manufacturer to thickness as indicated on drawings. Passes shall be not less than ½ inch and not greater than 2 inches.

D. Do not install spray polyurethane foam within 3 inches of heat emitting devices such as light fixtures and chimneys.

E. Finished surface of foam insulation to be free of voids and embedded foreign objects.

F. Remove masking materials and over spray from adjacent areas immediately after foam surface has hardened. Ensure cleaning methods do not damage work performed by other sections.

G. Trim, as required, any excess thickness that would interfere with the application of cladding/covering system by other trades.

H. Clean and restore surfaces soiled or damaged by work of the section. Consult with section of work soiled before cleaning to ensure methods used will not damage the work.

I. Do not permit adjacent work to be damaged by work of this section. Damage to work of this section caused by other sections shall be repaired by this section at the expense of the subcontractor causing the damage.

J. Complete connections to other components or repair any gaps, holes or other damage using material which conforms to ULC S710.1 Polyurethane Sealant Foam - One Component - Material or ULC S711.1 Polyurethane Sealant Foam - Two Components - Material and shall be installed in accordance with ULC S710.2 Polyurethane Sealant Foam - One component - Installation or ULC S711.2 Polyurethane Sealant Foam - Two Component - Installation, whichever is appropriate.

K. Where insulation is not protected, install intumescent paint to required wet or dry mil thickness or coverage rate in accordance with manufacturer's instructions, by brush, roller, conventional or airless spray.

3.06 TOLERANCES

A. Maximum variation from indicated thickness: minus (-) ¼ inch; plus (+) ½ inch.

3.07 PROTECTION

A. Cover the spray polyurethane foam with a thermal barrier when installed on the interior of the building.

END OF SECTION

SECTION 07 42 13
METAL WALL PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Insulated Metal Panel: Factory-assembled metal panel system for walls, with trim, related flashings and accessory components.
   1. Secondary sub-girt framing system, attached to building structural frame.

B. ACM Panel Fascia: Exterior cladding consisting of formed metal composite material (MCM) sheet, secondary supports, and anchors to structure, attached to solid backup.
   1. Matching flashing and trim.

1.02 RELATED REQUIREMENTS

A. Section 07 25 00 - Weather Barriers: Weather barrier under wall panels.

B. Section 07 92 00 - Joint Sealants: Sealing joints between metal wall panel system and adjacent construction.

1.03 REFERENCE STANDARDS

A. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document); 2015.

B. ASTM A480/A480M - Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip; 2016a.

C. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes; 2016a.

D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

E. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

F. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

G. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

H. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

I. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; 2010 (Reapproved 2015).

J. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

K. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.

L. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2012.

M. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.

N. ASTM D4214 - Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films; 2007 (Reapproved 2015).

O. ASTM D2244 - Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates; 2016.

P. ASTM D523 - Standard Test Method for Specular Gloss; 2014.

Q. ASTM D1781 - Standard Test Method for Climbing Drum Peel for Adhesives; 1998 (Reapproved 2012).

R. ASTM D1929 - Standard Test Method for Determining Ignition Temperature of Plastics; 2016.

S. ASTM D4145 - Standard Test Method for Coating Flexibility of Prepainted Sheet; 2010.

T. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.

1.04 SUBMITTALS

A. Shop Drawings: Indicate dimensions, layout, joints, construction details, and methods of anchorage.

B. Samples: Submit two samples of wall panel, 12 inch by 12 inch in size illustrating finish color, sheen, and texture.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in installing products of the type specified in this section with minimum three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.

B. Store prefinished material off the ground and protected from weather; prevent twisting, bending, or abrasion; provide ventilation; slope metal sheets to ensure proper drainage.

1.07 WARRANTY

A. See Section 01 77 00 - Closeout Procedures, for additional warranty requirements.

B. Correct defective work within a five year period after Date of Substantial Completion for degradation of panel finish, including color fading caused by exposure to weather.

C. Correct defective work within a five year period after Date of Substantial Completion, including defects in water tightness and integrity of seals.

D. MCM Sheet Manufacturer’s Finish Warranty: Provide manufacturer's written warranty stating that the finish will perform as follows for minimum of 20 years:
   1. Chalking: No more than that represented by a No. 8 rating based on ASTM D4214.
   2. Color Retention: No fading or color change in excess of 5 Hunter color difference units, calculated in accordance with ASTM D2244.
   3. Gloss Retention: Minimum of 30 percent gloss retention, when tested in accordance with ASTM D523.

E.

PART 2 PRODUCTS

2.01 INSULATED METAL PANELS

A. Manufacturers
   1. Basis of Design: Centria; Versawall: www.centria.com.
   2. Other Acceptable Manufacturers:
      a. ATAS International, Inc; Isoleren WL: www.atas.com/sle.
      b. MBCI; CF Architectural: www.mbci.com.
      c. Substitutions: See Section 01 60 00 - Product Requirements.

B. Panel System
   1. Metal Panel System: Factory-assembled metal panel system, with trim, related flashings and accessory components.
      a. Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.
      b. Accommodate tolerances of building structural framing.
   2. Performance Requirements:
      a. Thermal Performance: Provide thermal resistance through entire system; R-value of 10 minimum deg F hr sq ft/Btu, minimum.
      b. Structural Performance: Design and size to withstand all dead loads and wind loads caused by positive and negative wind pressure acting normal to plane of panel.
         1) Verify structural performance in accordance with ASTM E330/E330M, using test pressure 1.5 times design wind pressure, with 10 seconds duration of maximum load.
         2) Design Wind Loads: Calculated in accordance with applicable IBC code.
         3) Maximum Allowable Deflection of Panel: 1/90 of span.
      c. Movement: Accommodate the movement caused by the following without damage to system, components, or deterioration of seals:
         1) Normal movement between system components.
         2) Seasonal temperature cycling.
         3) Deflection of structural support framing,

C. Panels and Trim
   1. Wall Panels: Exterior and interior metal sheet skin, factory-assembled, with foamed in place insulation; exterior and interior sheet interlocking at edges, fitted with continuous gaskets.
      a. Panel Width: 48 inches.
      b. Profile: as indicated; horizontal panels.
      c. Panel Thickness: 2 inches.
      d. Exterior Sheet: Pre-finished aluminum, 20 gage, 0.032 inch minimum thickness.
      e. Surface: Embossed, Planked
      f. Interior Sheet: Galvanized steel, pre-finished, 22 gage, 0.0299 inch minimum base metal thickness.
      g. Panel Edge Profile: Tongue and groove, for flush seam.
      h. Fabricate panels in longest practicable lengths.
      i. Exterior Finish: Polyvinylidene fluoride (PVDF) coating; color as selected from manufacturer's standard range.

j. Interior Finish: Silicone polyester coating; color as selected from manufacturer's standard range.

2. Internal and External Corners: Same material, thickness, and finish as exterior sheets; factory-fabricated mitered to required angles in one continuous piece with minimum 18 inch returns.
   a. Profile: To suit system.
3. Trim, Closure Pieces, Caps, Flashings, Fascias, and Infills: Same material, thickness and finish as exterior sheets; factory-fabricated to required profiles; fabricated in longest practicable lengths.
   a. Profiles: To suit system.

D. Panel Materials
1. Precoated Galvanized Steel Sheet: ASTM A653/A653M, Commercial Steel (CS) or Forming Steel (FS), with G90/Z275 coating; continuous-coil-coated with acrylic primer coat, silicone polyester top coat, and polyester washcoat for panel back.
   a. Color of Exposed Exterior Surfaces: As selected by Architect from manufacturer's standard range.
2. Gaskets: Manufacturer's standard type suitable for use with panel system, permanently resilient.
3. Panel Sealants: Manufacturer's standard type suitable for use with installation of panel system; non-staining,non-skinning, non-shrinking, non-sagging.

E. Accessories
1. Concealed Sealants: Non-curing butyl sealant or tape sealant.
2. Exposed Sealants: Elastomeric; silicone, polyurethane, or silyl-terminated polyether/polyurethane.
3. Subgirts: As required for system design.
4. Anchors: Stainless steel.
5. Fasteners: Manufacturer's standard type to suit application; stainless steel with soft neoprene washers. Fastener cap same color as exterior panel.
6. Field Touch-up Paint: As recommended by panel manufacturer.
7. Bituminous Paint: Asphalt base.

2.02 METAL COMPOSITE MATERIAL (MCM) WALL PANELS

A. Manufacturers
1. Basis of Design: ATAS International, Inc; SterraCore: www.atas.com.
2. Other Acceptable Manufacturers:
   a. 3A Composites USA; Alucobond: www.alucobondusa.com/#sle.
   b. Laminators Inc; Omega-Lite: www.laminatorsinc.com/#sle.
   c. Substitutions: See Section 01 60 00 - Product Requirements.

B. Wall Panel System
1. Wall Panel System: Metal panels, fasteners, and anchors designed to be supported by framing or other substrate provided by others; provide installed panel system capable of maintaining specified performance without defects, damage or failure.
   a. Provide structural design by or under direct supervision of a Structural Engineer licensed in the State in which the Project is located.
   b. Provide panel jointing and weatherseal using a "wet", sealant-sealed system.
   c. Anchor panels to supporting framing without exposed fasteners.
2. Performance Requirements:

a. Thermal Movement: Provide for free and noiseless vertical and horizontal thermal movement due to expansion and contraction under material temperature range of minus 20 degrees F to 180 degrees F without buckling, opening of joints, undue stress on fasteners, or other detrimental effects; allow for ambient temperature at time of fabrication, assembly, and erection procedures.

3. Panels: One inch deep pans formed of metal composite material sheet by routing back edges of sheet, removing corners, and folding edges.
   a. Reinforce corners with riveted aluminum angles.
   b. Provide concealed attachment to supporting structure by adhering attachment members to back of panel; attachment members may also function as stiffeners.
   c. Maintain maximum panel bow of 0.8 percent of panel dimension in width and length; provide stiffeners of sufficient size and strength to maintain panel flatness without showing local stresses or read-through on panel face.
   d. Secure members to back face of panels using structural silicone sealant approved by MCM sheet manufacturer.
   e. Fabricate panels under controlled shop conditions.
   f. Where final dimensions cannot be established by field measurement before commencement of manufacturing, make allowance for field adjustments without requiring field fabrication of panels.
   g. Fabricate as indicated on drawings and as recommended by MCM sheet manufacturer.
      1) Make panel lines, breaks, curves and angles sharp and true.
      2) Keep plane surfaces free from warp or buckle.
      3) Keep panel surfaces free of scratches or marks caused during fabrication.
   h. Provide joint details providing a watertight and structurally sound wall panel system that allows no uncontrolled water penetration on inside face of panel system.
   i. For "dry" jointing, secure extrusions to returned pan edges with stainless steel rivets; provide means of concealed drainage with baffles and weeps for water that might accumulate in members of system.

C. Materials
   1. Metal Composite Material (MCM) Sheet: Two sheets of aluminum sandwiching a core of extruded thermoplastic material; no foamed insulation material content.
      a. Overall Sheet Thickness: 3 mm, minimum.
      b. Bond and Peel Strength: No adhesive failure of the bond between the core and the skin nor cohesive failure of the core itself below 22.4 inch-pound/inch with no degradation in bond performance, when tested in accordance with ASTM D1781, simulating resistance to panel delamination, after 8 hours of submersion in boiling water and after 21 days of immersion in water at 70 degrees F.
      c. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E84.
      d. Flammability: Self-ignition temperature of 650 degrees F or greater, when tested in accordance with ASTM D1929.
      e. Factory Finish: One coat fluoropolymer resin coating, approved by the coating manufacturer for the length of warranty specified for the project, and applied by coil manufacturing facility that specializes in coil applied finishes.

1) Coating Flexibility: Pass ASTM D4145 minimum 1T-bend, at time of manufacturing.
2) Long-Term Performance: Not less than that specified under WARRANTY in PART 1.

2. Metal Framing Members: Include sub-girts, zee-clips, base and sill angles and channels, hat-shaped and rigid channels, and furring channels required for complete installation.
   a. Provide material strength, dimensions, configuration as required to meet the applied loads applied and in compliance with applicable building code.
   b. Sheet Steel Components: ASTM A653/A653M galvanized to G90/Z275 or zinc-iron alloy-coated to A60/ZF180; or ASTM A792/A792M aluminum-zinc coated to AZ60/AZM180.
   c. Stainless Steel Sheet Components: ASTM A480/A480M.
3. Anchors, Clips and Accessories: Use one of the following:
   a. Stainless steel complying with ASTM A276/A276M, ASTM A480/A480M, or ASTM A666.
   b. Steel complying with ASTM A36/A36M and hot-dipped galvanized to ASTM A153/A153M.
   c. Steel complying with ASTM A36/A36M and hot-dipped galvanized to ASTM A123/A123M Coating Grade 10.
4. Fasteners:
   a. Exposed Fasteners: Stainless steel; permitted only where absolutely unavoidable and subject to prior approval of the Architect.
   b. Screws: Self-drilling or self-tapping Type 410 stainless steel or zinc-alloy steel hex washer head, with EPDM or PVC washer under heads of fasteners bearing on weather side of metal wall panels.
   c. Bolts: Stainless steel.
5. Provide panel system manufacturer's and installer's standard corrosion resistant accessories, including fasteners, clips, anchorage devices and attachments.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that building framing members are ready to receive panels.

B. Verify that weather barrier has been installed over substrate completely and correctly.

3.02 PREPARATION

A. Install subgirts perpendicular to panel length, securely fastened to substrates and shimmed and leveled to uniform plane. Space at intervals indicated.

3.03 GENERAL INSTALLATION

A. Install panels on walls and soffits in accordance with manufacturer's instructions.

B. Fasten panels to structural supports; aligned, level, and plumb.

C. Locate joints over supports.

D. Lap panel ends minimum 2 inches.

E. Use concealed fasteners unless otherwise approved by Architect.

F. Seal and place gaskets to prevent weather penetration. Maintain neat appearance.

3.04 MCM PANEL INSTALLATION

A. Do not install products that are defective, including warped, bowed, dented, and broken members, and members with damaged finishes.

B. Comply with instructions and recommendations of MCM sheet manufacturer and wall system manufacturer, as well as with approved shop drawings.

C. Install wall system securely allowing for necessary thermal and structural movement; comply with wall system manufacturer's instructions for installation of concealed fasteners.

D. Do not handle or tool products during erection in manner that damages finish, decreases strength, or results in visual imperfection or failure in performance. Return component parts that require alteration to shop for refabrication, if possible, or for replacement with new parts.

E. Do not form panels in field unless required by wall system manufacturer and approved by the Architect; comply with MCM sheet manufacturer's instructions and recommendations for field forming.

F. Separate dissimilar metals; use gasket fasteners, isolation shims, or isolation tape where needed to eliminate possibility of electrolytic action between metals.

G. Where joints are designed for field applied sealant, seal joints completely with specified sealant.

H. Install square, plumb, straight, and true, accurately fitted, with tight joints and intersections maintaining the following installation tolerances:
   1. Variation From Plane or Location: 1/2 inch in 30 feet of length and up to 3/4 inch in 300 feet, maximum.
   2. Deviation of Vertical Member From True Line: 0.1 inch in 25 feet run, maximum.
   3. Deviation of Horizontal Member From True Line: 0.1 inch in 25 feet run, maximum.
   4. Offset From True Alignment Between Two Adjacent Members Abutting End To End, In Line: 0.03 inch, maximum.

I. Replace damaged products.

3.05 TOLERANCES

A. Maximum Offset From True Alignment Between Adjacent Members Butting or In Line: 1/16 inch.

3.06 CLEANING

A. Remove site cuttings from finish surfaces.

B. Remove protective material from wall panel surfaces.

C. Clean and wash prefinished surfaces with mild soap and water; rinse with clean water.

D. Upon completion of installation, thoroughly clean prefinished aluminum surfaces in accordance with AAMA 609 & 610.

END OF SECTION

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SECTION 07 42 33
PHENOLIC WALL PANELS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Exterior solid phenolic cladding panel system and accessories as required for a complete drained and back-ventilated rainscreen system.
   1. Wall panels.
   2. Fascia.

B. Interior solid phenolic wall lining panels.

1.02 RELATED SECTIONS

A. Section 01 74 19 – Construction Waste Management.

B. Section 01 81 13 – Sustainable Design Requirements.

1.03 REFERENCES

A. ASTM International (ASTM):
   1. ASTM B 117 - Standard Practice for Operating Salt Spray (Fog) Apparatus.
   2. ASTM D 635 - Standard Test Method for Small Scale Burning.
   3. ASTM D 1929 - Standard Test Method for Ignition Temperature.
   4. ASTM D 2244 - Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates.
   5. ASTM D 2247 - Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity.
   6. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
   7. ASTM E 119 - Standard Test Method for Fire Rated or Fire Resistive Construction.
   8. ASTM E 330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors Under the Influence of Wind Loads.

B. International Organization for Standardization (ISO):
   1. ISO 105 A02-93 - Tests for Color Fastness -- Part A02: Grey scale for assessing change in color.
   2. ISO 178 - Determination of Flexural Properties.
   3. ISO 527-3 - Determination of Tensile Properties.
   4. ISO 846 - Evaluation of the Action of Organisms.

C. National Fire Protection Association (NFPA):
   1. NFPA 268 - Standard Test Method for Determining Ignitibility of Exterior Wall Assemblies Using a Radiant Heat Energy Source.
   2. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components

1.04 LEED REQUIREMENTS

A. LEED Focus Materials (LFMs) For This Section:
   1. Targeted products containing Recycled Content (MRc4)
   2. Targeted products containing Regional Material (MRc5)

1.05 SUBMITTALS

A. Submit under provisions of Section 01 30 00.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. Shop Drawings: Submit plan, section, elevation and perspective drawings necessary to describe and convey the layout, profiles and product components, including edge conditions, panel joints, fixture location, anchorage, accessories, finish colors, patterns and textures.

D. Code Compliance: Documents showing product compliance with local building code shall be submitted prior to the bid. These documents shall include, but not be limited to, appropriate Evaluation Reports and/or test reports supporting the use of the product. Alternate materials must be approved by the architect of record prior to the bid date.

E. Engineering Calculations: Submit engineering calculations as required by the local building code, showing that the installed panels and attachments system meets the wind load requirements for the project.

F. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns. Please note that samples are only representative for color and pattern and not for thickness or edge finish. Metallic colors may also show a slight fluctuation in appearance do to the metal flake orientation from batch to batch.

G. Verification Samples: For each finish product specified, two samples a minimum of 3.5 inches by 3.5 inches (89 mm by 89 mm) representing actual product, color, and patterns. Sample edges may vary from field panel edges.

H. Operation and Maintenance Data: Submit operation, maintenance, and cleaning information for products covered under this section.

I. Project Compliance: Documents showing product compliance with project specifications to include FSC Certification, Greenguard, LEED, Environmental Product Declarations, etc.

J. LEED Product and Material Data Summary Form: For all installed products and materials of this Section, complete the “LEED Product and Material Data Summary Form” (attached to end of Section 01 81 13 - Sustainable Design Requirements)
   1. Product Material Cost: Provide the cost for material, or an assembled product, including taxes and delivery but excluding any cost for labor and equipment required for installation after the material is delivered to the site.
   2. Product Data for Credit MRc4, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating cost for each product having recycled content.
   3. Product Data for Credit MRc5, Regional Material: For products having regional materials, documentation indicating location of raw material extraction, harvest or recovery, as well as, manufacture (location of final assembly) within 500 miles of project site. Include statement indicating cost for each material or component of the assembled product.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: All panel products specified in this section will be supplied by a single manufacturer with a minimum of 25 years' experience.
   1. Products covered under the Work listed in this section are to be manufactured in an ISO 9001 certified facility.
   2. Products covered under the work listed in this section are to be manufactured in an ISO 14001 Certified facility.

B. Installer Qualifications: All products listed in this section are to be installed by an installing firm who can prove 3 years in business and exemplary workmanship. Installing firm must have evidence of installing rainscreen wall panel systems and is suitable for the execution of the work.

C. Pre-Installation Meetings: Conduct pre-installation conference to verify project requirements, substrate conditions, manufacturer's installation instructions and manufacturer's warranty requirements.

D. Sustainability and LEED Standards Certification:
   1. Regional manufactured products with percentage by weight.
   2. Recycled content calculated as 1/2 preconsumer + postconsumer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Delivery:
   1. During transportation, use stable, flat pallets that are at least the same dimension as the sheets.
   2. Materials shall be packaged to minimize or eliminate the possibility of damage during shipping. Items such as wooden side boards, wooden lid, and spacers or protective sheeting between panels shall be used to protect the panels from surface and/or edge damage.

B. Storage:
   1. Store products in an enclosed area protected from direct sunlight, moisture and heat. Maintain a consistent temperature and humidity.
   2. Store products in manufacturer's and/or fabricators unopened packaging until ready for installation.
   3. Stack panels using protective dividers to avoid damage to decorative surface.
   4. For horizontal storage, store sheets on pallets of equal or greater size as the sheets with a protective layer between the pallet and sheet and on top of the uppermost sheet.
   5. Do not store sheets, or fabricated panels vertically.

C. Handling:
   1. Remove protective film within 24 hours of the panels being removed from the pallet.
   2. When moving sheets, lift evenly to avoid dragging panels across each other and scratching the decorative surface.
   3. Remove all labels and stickers immediately after installation.

1.08 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

B. Field Measurements: Verify actual measurements/openings by field measurements performed by the installer prior to release for fabrication. Recorded measurements to be indicated on shop drawings based on field measurements provided by the installer. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

1.09 WARRANTY

A. Warranty: At project closeout, provide manufacturer's limited warranty documentation and material data property sheet.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: Trespa International B.V.; P.O. Box 110, 6000 AC Weert Wetering 20, 6002 SM Weert The Netherlands; www.trespa.com.
   1. Manufacturer's Representative: Trespa North America, Ltd.; 350 5th Ave Suite 4610 New York, New York 10118. ASD. Toll Free Tel: (800) 4-TRESPA. Tel: (858) 679-2090. Fax: (858) 679-9568. Email: info.northamerica@trespa.com. Web: http://www.trespa.com/na.

B. Alternate Products:
   1. FunderMax Exterior F Quality

C. Substitutions: See Section 01 60 00 - Product Requirements

2.02 WALL PANELS

A. Solid Phenolic Wall Panels: Trespa Meteon by Trespa International B. V. as represented by Trespa North America, LTD. Lorrie Aracri , Territory Manager (646) 248 2336 L.aracri@trespa.com <mailto:L.aracri@trespa.com>
   1. Material: Solid panel manufactured using a combination of high pressure and temperature to create a flat panel created from thermosetting resins, homogenously reinforced with natural fibers and an integrated decorative surface or printed décor.
   2. Panel Size: 14’x7’, or 12’x6’, or 8’x6’, or 10’x5’
   3. Panel Thickness: 10mm (3/8”)
   4. Panel Type: Single sided decorative, or double sided decorative, or Varitop, or Duocolor.
   5. Panel Decor: Unicolor, or Metallic, or Lumen, or Focus, or Wood Décor, or Natural Decor. As selected by the Architect from manufacturer's standard decor palette, see Standard Delivery Program North America
   6. Panel Core: Fire retardant (FR) black core.
   7. Physical Properties:
      a. Modulus of Elasticity: 1,300,000 psi (9000 N/mm2) minimum, ISO 178.
      b. Tensile Strength: 10,100 psi (70 N/mm2) minimum, ISO 527-2.
      c. Flexural Strength: 14,500psi (120 N/mm2) minimum, ISO 178.
      d. Thermal Conductivity: 2.1 BTU/inch/ft2.hr.°F, EN 12524.
      e. Structural Performance (ASTM E330):
         1) Panels shall be designed to withstand the Design Wind Load based upon the local building code, but in no case less than 15 pounds per square foot (psf). Wind load testing shall be done in accordance with this standard to obtain the following results:
         2) Normal to the plane of the wall, the maximum panel deflection shall not exceed L/175

3) Normal to the plane of the wall between supports, deflection of the aluminum sub-framing members shall not exceed L/175 or 3/4 inch, whichever is less
   (a) At 1-1/2 times design pressure, permanent deflection of framing members shall not exceed L/100 of span length and components shall not experience failure or gross permanent distortion.
   (b) If system tests are not available, mock ups shall be constructed and tests performed under the direction of an independent third party laboratory which show compliance to the minimum standards listed above.

8. 8. Fire Performance:
   a. Flame Spread: Class A, Less than 25, ASTM E 84.
   b. Smoke Development: Less than 450, ASTM E 84.
   c. Ignition Temperature: Greater than 650 degree F (350 degree C) above ambient, ASTM D1929.
   d. Burning Classification: CC1 or CC2, ASTM D635.
   e. When required for compliance with local building codes, the wall cladding assembly shall show no degradation of the rating of Fire Resistant Assemblies, ASTM E119.
   f. When required for compliance with local building codes, the wall cladding assembly including cladding and non-cladding elements such as, but not limited to, specific weather resistive barriers and/or exterior insulation materials, shall meet the performance requirements of NFPA 285. Performance shall be determined by actual testing in accordance with NFPA 285 or through an equivalency analysis provided by a recognized fire protection expert.
   g. When required for compliance with local building codes, the wall cladding assembly shall not ignite when exposed to a radiant heat energy source, NFPA 268.
9. Finish Performance: Electron Beam Cure resin in conformance with the following general requirements:
   a. Decor: As selected by the architect/engineer from manufacturer's standard decors or a custom color to be matched by the panel supplier.
   b. Humidity Resistance: No formation of blisters when subjected to condensing water fog at 100% relative humidity and 100 degree F (38 degree C) for 3000 hours, ASTM D 2247.
   c. Salt Spray Resistance: Corrosion creepage from scribe line (1/16 inch (1.6 mm) max.) and minimum blister rating of 8 within the test specimen field, ASTM B117.
   d. Weather Exposure: Tested to two standards using a Xenon Arc Light and water to simulate weather exposure.
      1) Florida test cycle of 3000 hours=10 years (vertical application)
      2) EN 438-2:29 Western European test cycle of 1000 hours=10 years (vertical application)
   e. Color Stability: The decorative surface comply with, classification, 4 - 5 measured with the grey scale according to ISO 105 A02-93 according to test method EN 438-2:29.
   f. Microbial Characteristics: Will not support micro-organic growth (ISO 846).

B. Mounting Systems:
   1. TS110-285 - Exposed fastening on fixed depth aluminum sub-framing tested and meeting the performance requirements of NFPA 285.

2. TS210-285 - Concealed fastening over fixed depth aluminum sub-framing tested and meeting the performance requirements of NFPA 285.
3. Other installation systems - Include test documentation showing compliance with the performance criteria set forth in the specification and in accordance with the local building code.

C. Aluminum Sub Structure: Aluminum sub-structure designed to withstand structural loading due to wind load and the dead load of the panel, painted as required to conceal behind the open joinery of the attachment system.
1. Extrusions, including corner closures, joint closures and vent screens, formed members, sheet, and plate shall conform with the recommendations of the manufacturer.

D. Extruded Aluminum Trim: Color as specified in the finish schedule.

E. Fasteners (Concealed/Exposed): Fasteners shall be non-corrosive and as recommended by panel manufacturer. Exposed fasteners shall be colored to match panels where required by the architect.

2.03 FABRICATION

A. Panels: Solid phenolic wall panels with no voids, air spaces or foamed insulation in the core material.

B. Accessory items in accordance with manufacturer's recommendations and approved submittals

C. Panel Weight: 10 mm (3 lb/ ft2).

D. Panel Bow: = 2 mm / m (= 0.079 inch/39.38 inches).

E. Panel Dimensions: Field fabrication shall be allowed where necessary, but shall be kept to a minimum. All fabrication shall be done under controlled shop conditions when possible.

F. Appearance: Panel lines, breaks, and angles shall be sharp, true, and surfaces free from warp and buckle

PART 3 - EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. Surfaces to receive panels shall be even, smooth, dry, and free from defects detrimental to the installation of the panel system. Notify Contractor in writing of conditions detrimental to proper and timely completion of the work.

C. Confirm exterior sheathing is plumb and level, with no deflection greater than 1/4 inch (6 mm) in 20 feet (6096 mm).

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

E. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install solid phenolic wall panels and sub-frame system in accordance with manufacturer's instructions.

B. Install solid phenolic wall panels plumb and level and accurately spaced in accordance with manufacturer's recommendations and approved submittals and drawings.

C. Anchor panels and sub-framing securely per engineering recommendations and in accordance with approved shop drawings to allow for necessary movement and structural support.

D. Fasten solid phenolic wall panels with fasteners approved for use with supporting substrate.

E. Do not install panels or component parts which are observed to be defective or damaged including, but not limited to: warped, bowed, abraded, scratched, and broken members.

F. Do not cut or trim component parts during installation in a manner that would damage the finish, decrease the strength, or result in visual imperfection or a failure in performance. Return component parts with require alteration to the shop for re-fabrication or replacement.

G. Install profiles and trim with fasteners appropriate for use with adjoining construction as indicated on the Contract Drawings and as recommended by manufacturer.

3.04 ADJUSTING AND CLEANING

A. Remove masking or panel protection as soon as possible after installation. Any masking intentionally left in place after panel installation on an elevation, shall become the responsibility of the General Contractor to remove.

B. Adjust final panel installation so that all joints are true and even throughout the installation. Panels out of plane shall be adjusted with the surrounding panels to minimize any imperfection.

C. Repair panels with minor damage. Remove and replace panels damaged beyond repair as a direct result of the panel installation. After installation, panel repair and replacement shall become the responsibility of the General Contractor.

D. Clean finished surfaces as recommended by panel manufacturer. After installation cleaning, cleaning during construction shall become the responsibility of the General Contractor.

END OF SECTION

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SECTION 07 53 00
ELASTOMERIC MEMBRANE ROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Elastomeric roofing membrane, adhered conventional application.

B. Insulation, flat and tapered.

C. Deck sheathing.

D. Flashings.

E. Roofing cant strips, stack boots, roofing expansion joints, and walkway pads.

1.02 RELATED REQUIREMENTS

A. Section 05 31 00 - Steel Decking: Product requirements for acoustical insulation for deck flutes, for placement by this section.

B. Section 06 10 00 - Rough Carpentry: Wood nailers and curbs.

C. Section 07 62 00 - Sheet Metal Flashing and Trim: Counterflashings, reglets.

D. Section 07 71 00 - Roof Specialties: Prefabricated roofing expansion joint flashing, copings, fascia; to be included in roofing system warranty.

E. Section 07 72 00 - Roof Accessories: Roof-mounted units; prefabricated curbs.

F. Section 26 41 13 - Lightning Protection for Structures.

1.03 REFERENCE STANDARDS

A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2015.

B. ASTM C726 - Standard Specification for Mineral Wool Roof Insulation Board; 2012.

C. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2016.

D. ASTM D4637/D4637M - Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane; 2015.

E. FM DS 1-28 - Wind Design; 2007.

F. NRCA (RM) - The NRCA Roofing Manual; 2017.

G. NRCA (WM) - The NRCA Waterproofing Manual; 2005.

H. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all affected installers; review preparation and installation procedures and coordination and scheduling necessary for related work.

1.05 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Product Data: Provide data indicating membrane materials, flashing materials, insulation, and and fasteners.

C. Shop Drawings: Indicate joint or termination detail conditions, conditions of interface with other materials, setting plan for tapered insulation, and mechanical fastener layout.

D. Manufacturer's Installation Instructions: Indicate membrane seaming precautions and perimeter conditions requiring special attention.

E. Manufacturer's Field Reports: Indicate procedures followed, ambient temperatures, humidity, and supplementary instructions given.

F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in manufacturer's original containers, dry, undamaged, with seals and labels intact.

B. Store products in weather protected environment, clear of ground and moisture.

C. Protect foam insulation from direct exposure to sunlight.

1.08 FIELD CONDITIONS

A. Do not apply roofing membrane during unsuitable weather.

B. Do not apply roofing membrane when ambient temperature is below 40 degrees F or above 90 degrees F.

C. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.

D. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.

1.09 WARRANTY

A. See Section 01 77 00 - Closeout Procedures, for additional warranty requirements.

B. Correct defective Work within a two year period after Date of Substantial Completion.

C. Provide 15 year manufacturer's material and labor warranty to cover failure to prevent penetration of water.

D. Provide Owner with written warranty stating that roofing system will remain weathertight for minimum period two (2) years from date of Substantial Completion of project (as certified by Architect) and that any and all damage resulting from failure to provide above stated performance shall be repaired to satisfaction of Owner and Architect. Pay for all costs incurred.

E. Submit executed copy of roofing manufacturer's Total System Warranty agreement including flashing endorsement, signed by an authorized representative of modified bitumen sheet roofing system manufacturer, on form that was published with product literature as of date of Contract Documents.

1. Warranty Period: Base Bid 15 years, beginning on date of Substantial Completion.
2. Scope of coverage: Materials and workmanship.

3. Monetary limitations: No dollar limit. Non pro-rated. Warranty shall include labor and materials of repairs.
4. Pay for all costs incurred in obtaining warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. EPDM Membrane Materials:
1. Carlisle Roofing Systems, Inc; Sure-Seal EPDM: www.carlisle-syntec.com/#sle.
2. Firestone Building Products, LLC: www.firestonebpco.com.
3. Versico, a division of Carlisle Construction Materials Inc; VersiGard EPDM: www.versico.com/#sle.
4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ROOFING

A. Elastomeric Membrane Roofing: One ply membrane, fully adhered, over vapor retarder and insulation.

B. Roofing Assembly Requirements:
1. Roof Covering External Fire Resistance Classification: UL (DIR) certified Class A.
2. Factory Mutual Classification: Class 1 and windstorm resistance of 1-60, in accordance with FM DS 1-28.

C. Acceptable Insulation Types - Tapered Application:
1. Uniform thickness polyisocyanurate board covered with tapered polyisocyanurate board.

2.03 ROOFING MEMBRANE AND ASSOCIATED MATERIALS

A. Membrane: Ethylene-propylene-diene-terpolymer (EPDM); non-reinforced; complying with minimum properties of ASTM D4637/D4637M.
1. Thickness: 0.060 inch (60 mil).
2. Sheet Width: 120 inch, minimum; factory-fabricate into largest sheets possible.
3. Solar Reflectance: 0.75, minimum, initial, and 0.64, minimum, 3-year, certified by Cool Roof Rating Council.
4. Thermal Emittance: 0.84, minimum, initial, and 0.87, minimum, 3-year, certified by Cool Roof Rating Council.
5. Color: Gray.

B. Seaming Materials: Standard synthetic-rubber polymer primer and 6-inch wide minimum, butyl splice tape with release film.

C. Membrane Fasteners: As recommended by and approved by membrane manufacturer.

D. Flexible Flashing Material: Same material as membrane; conforming to the following:
1. Thickness: 60 mil.
2. Tensile Strength: 1,200 psi.
3. Elasticity: 50 percent with full recovery without set.
4. Color: Gray.

2.04 COVER BOARD

A. Fiberglass Mat Faced Gypsum Roof Board:
1. Thickness: 5/8 inch.
2. Width: 4 feet.

3. Length: 8 feet.
4. Weight: 2.5 lb/sq. ft.
5. Surfacing: Fiberglass mat with non-asphaltic coating.
6. Flexural Strength, Parallel (ASTM C473): 100 lbf, minimum.
7. Flute Span (ASTM E661): 8 inches.
8. Permeance (ASTM E96): greater than 17 perms.
9. R-Value (ASTM C518): 0.67.
10. Water Absorption (ASTM C1177): Less than 10 percent of weight.
11. Compressive Strength (Applicable Sections of ASTM C472): 900 pounds per square inch.
12. Surface Water Absorption (ASTM C473): Not more than 2 grams.
13. Acceptable Products:
    a. DensDeck Prime, Georgia-Pacific Gypsum.

2.05 INSULATION

A. Polyisocyanurate (ISO) Board Insulation: Rigid cellular foam, complying with ASTM C1289.
1. Classifications:
    a. Type II:
        1) Class 1 - Faced with glass fiber reinforced cellulistic felt facers on both major surfaces of core foam.
        2) Compressive Strength: Classes 1-2-3, Grade 2 - 20 psi (138 kPa), minimum.
        3) Thermal Resistance, R-value: At 1-1/2 inch thick (UNO); Class 1, Grades 1-2-3 - 8.4 (1.48) at 75 degrees F.
2. Board Size: 48 by 96 inch.
3. Board Thickness: 1.5 inch minimum.
4. Tapered Board: Slope as indicated; minimum thickness 4-1/2 inch; fabricate of fewest layers possible.
    a. Minimum slope: 1/4 inch per foot
    b. Sumps at drains: 4'-0" square; 1/2" per foot slope.
5. Board Edges: Square.

2.06 ACCESSORIES

A. Prefabricated Roofing Expansion Joint Flashing: Sheet butyl over closed-cell foam backing seamed to stainless steel flanges.

B. Stack Boots: Prefabricated flexible boot and collar for pipe stacks through membrane; same material as membrane.

C. Insulation Joint Tape: Glass fiber reinforced type as recommended by insulation manufacturer, compatible with roofing materials; 6 inches wide; self adhering.

D. Insulation Fasteners: Appropriate for purpose intended and approved by roofing manufacturer.

E. Membrane Adhesive: As recommended by membrane manufacturer.

F. Thinners and Cleaners: As recommended by adhesive manufacturer, compatible with membrane.

G. Insulation Adhesive: As recommended by insulation manufacturer.

H. Walkway Pads: Suitable for maintenance traffic, contrasting color or otherwise visually distinctive from roof membrane.
1. Composition: Asphaltic with mineral granule surface or Roofing membrane manufacturer's standard.

2. Size: As indicated.
3. Surface Color: White.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and site conditions are ready to receive work.

B. Verify deck is supported and secure.

C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.

D. Verify deck surfaces are dry and free of snow or ice.

E. Verify that roof openings, curbs, and penetrations through roof are solidly set, and cant strips are in place.

3.02 METAL DECK PREPARATION

A. Clean surface and flutes of dust, debris, moisture, and other substances detrimental to roofing installation. Follow roofing system manufacturer's written instructions for additional procedures. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction.
   1. Remove roof-drain plugs when no work is taking place or when rain is forecast.

3.03 INSULATION - UNDER MEMBRANE

A. Attachment of Insulation:
   1. Mechanically fasten each layer of insulation to deck in accordance with roofing manufacturer's instructions and Factory Mutual requirements.

B. Lay subsequent layers of insulation with joints staggered minimum 6 inch from joints of preceding layer.

C. Place tapered insulation to the required slope pattern in accordance with manufacturer's instructions.

D. On metal deck, place boards parallel to flutes with insulation board edges bearing on deck flutes.

E. Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.

F. Tape joints of insulation in accordance with roofing and insulation manufacturers' instructions.

G. At roof drains, use factory-tapered boards to slope down to roof drains over a distance of 18 inches.

H. Install cover board over insulation with long joints in continuous straight lines with end joints staggered between rows. Adhesive attach cover board, following manufacturer recommendations.
   1. For multilayer locations, lay subsequent coverboard layers with joints staggered minimum 6 inch from joints of preceding layer.

I. Do not apply more insulation than can be covered with membrane in same day.

3.04 MEMBRANE APPLICATION

A. Apply elastomeric membrane roofing system in accordance with manufacturer's recommendations and NRCA (WM) applicable requirements.

B. Roll out membrane, free from wrinkles or tears. Place sheet into place without stretching.

C. Shingle joints on sloped substrate in direction of drainage.

D. Fully Adhered Application: Apply adhesive to substrate at rate of ____ gal/square. Fully embed membrane in adhesive except in areas directly over or within 3 inches of expansion joints. Fully adhere one roll before proceeding to adjacent rolls.

E. Fully Adhered Application: Apply adhesive to substrate and membrane at rate required by manufacturer. Fully embed membrane in adhesive except in areas directly over or within 3 inches of expansion joints. Fully adhere one roll before proceeding to adjacent rolls.
   1. Protect surface from discoloration from bonding adhesive.
   2. Do not place bonding adhesive containers or lids on membrane surface.

F. Overlap edges and ends and seal seams by contact tape, minimum 6 inches. Seal permanently waterproof. Apply uniform bead of sealant to joint edge.

G. At intersections with vertical surfaces:
   1. Extend membrane over cant strips and up a minimum of 8 inches onto vertical surfaces.
   2. Fully adhere flexible flashing over membrane and up to termination bar.

H. Around roof penetrations, seal flanges and flashings with flexible flashing.

I. Install roofing expansion joints where indicated. Make joints watertight.
   1. Install prefabricated joint components in accordance with manufacturer's instructions.

J. Coordinate installation of roof drains and related flashings.

K. Coordinate installation of associated counterflashings installed under other sections.

3.05 ROOF WALKWAY INSTALLATION

A. Flexible Walkways: Install walkway products in locations indicated. Adhere walkway products to substrate with compatible adhesive according to roofing system manufacturer's written instructions.

3.06 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for general requirements for field quality control and inspection.

B. Require site attendance of roofing and insulation material manufacturers daily during installation of the Work.

3.07 CLEANING

A. See Section 01 74 19 - Construction Waste Management and Disposal, for additional requirements.

B. Remove bituminous markings from finished surfaces.

C. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and conform to their documented instructions.

D. Repair or replace defaced or damaged finishes caused by work of this section.

3.08 PROTECTION

A. Protect installed roofing and flashings from construction operations.

B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

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SECTION 07 54 19
PVC THERMOPLASTIC SINGLE-PLY ROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Adhered system with PVC thermoplastic roofing membrane.

B. Insulation, flat and tapered.

C. Flashings.

D. Roofing stack boots, roofing expansion joints, and walkway pads.

1.02 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Wood nailers and curbs.

B. Section 07 62 00 - Sheet Metal Flashing and Trim: Counterflashings, reglets.

C. Section 07 71 00 - Roof Specialties: Prefabricated roofing expansion joint flashing.

1.03 REFERENCE STANDARDS

A. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2013.

B. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2016.

C. ASTM D4434/D4434M - Standard Specification for Poly(Vinyl Chloride) Sheet Roofing; 2015.

D. ASTM E1980 - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces; 2011.

E. FM DS 1-28 - Wind Design; 2007.

F. FM DS 1-29 - Roof Deck Securement and Above-Deck Roof Components; Factory Mutual System; 2006.

G. NRCA (RM) - The NRCA Roofing Manual; 2017.

H. NRCA (WM) - The NRCA Waterproofing Manual; 2005.

I. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

1. Review preparation and installation procedures and coordinating and scheduling required with related work.

1.05 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Product Data: Provide manufacturer's written information listed below.

1. Product data indicating membrane materials, flashing materials, insulation, and fasteners.

C. Shop Drawings: Indicate joint or termination detail conditions, conditions of interface with other materials, setting plan for tapered insulation, and mechanical fastener layout.

D. Manufacturer's Field Reports: Indicate procedures followed, ambient temperatures, humidity, and supplementary instructions given.

E. Manufacturer's Installation Instructions: Indicate membrane seaming precautions and perimeter conditions requiring special attention.

F. Warranty:
   1. Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
   2. Submit installer's certification that installation complies with all warranty conditions for the waterproof membrane.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three (3) years of documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section:
   1. With minimum three (3) years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in manufacturer's original containers, dry, undamaged, with seals and labels intact.

B. Store products in weather protected environment, clear of ground and moisture.

C. Protect foam insulation from direct exposure to sunlight.

1.08 FIELD CONDITIONS

A. Do not apply roofing membrane during unsuitable weather.

B. Do not apply roofing membrane when ambient temperature is below 40 degrees F or above 90 degrees F.

C. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.

D. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.

1.09 WARRANTY

A. See Section 01 77 00 - Closeout Procedures, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Carlisle SynTec: www.carlisle-syntec.com/sle.

B. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ROOFING APPLICATIONS

A. PVC Membrane Roofing: One ply membrane, fully adhered, over insulation.

B. Roofing Assembly Performance Requirements and Design Criteria:
   1. Solar Reflectance Index (SRI): Minimum of 64 based on three-year aged value; if three-year aged data is not available, minimum of 82 initial value.
      a. Calculate SRI in accordance with ASTM E1980.
      b. Field applied coating may not be used to achieve specified SRI.

2.03 ROOFING MEMBRANE AND ASSOCIATED MATERIALS

A. Membrane:
   1. Material: Polyvinyl chloride (PVC) complying with ASTM D4434/D4434M.
   2. Thickness: 60 mils (0.060 inch), minimum.
   3. Sheet Width: Factory fabricated into largest sheets possible.
   4. Color: Gray.

B. Seaming Materials: As recommended by membrane manufacturer.

C. Membrane Fasteners: As recommended and approved by membrane manufacturer.

D. Flexible Flashing Material: Same material as membrane.

2.04 DECK SHEATHING AND COVER BOARDS

A. Deck Sheathing and Cover Board: Glass mat faced gypsum panels, ASTM C1177/C1177M, fire resistant type, 5/8 inch thick.
   1. Product: GP Dens-Deck Prime.

2.05 INSULATION

A. Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class 1, fiber reinforced felt both faces; Grade 2.
   1. Compressive Strength: 20 psi.
   2. Tapered Board: Slope as indicated; minimum thickness 4-1/2 inch; fabricate of fewest layers possible.
      a. Minimum slope: 1/4 inch per foot
      b. Sumps at drains 4'-0" square; 1/2" per foot slope

2.06 ACCESSORIES

A. Prefabricated Roofing Expansion Joint Flashing: Sheet butyl over closed cell foam backing seamed to stainless steel flanges.

B. Prefabricated Flashing Accessories:
   1. Corners and Seams: Same material as membrane, in manufacturer's standard thicknesses.
   2. Penetrations: Same material as membrane, with manufacturer's standard cut-outs, rigid inserts, clamping rings, and flanges.

C. Insulation Joint Tape: Glass fiber reinforced type as recommended by insulation manufacturer, compatible with roofing materials; 6 inches wide; self adhering.

D. Insulation Fasteners: Appropriate for purpose intended and approved by roofing manufacturer.

E. Insulation Adhesive: As recommended by membrane manufacturer.

F. Membrane Adhesive: As recommended by membrane manufacturer.

G. Surface Conditioner for Adhesives: Compatible with membrane and adhesives.

H. Sealants: As recommended by membrane manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces and site conditions are ready to receive work.

B. Verify deck is supported and secure.

C. Verify deck is clean and smooth, flat, free of depressions, waves, or projections, properly sloped and suitable for installation of roof system.

D. Verify deck surfaces are dry and free of snow or ice.

E. Verify that roof openings, curbs, and penetrations through roof are solidly set, and reglets are in place.

3.02 METAL DECK PREPARATION

A. Clean surface and flutes of dust, debris, moisture, and other substances detrimental to roofing installation. Follow roofing system manufacturer's written instructions for additional procedures. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction.
   1. Remove roof-drain plugs when no work is taking place or when rain is forecast.

3.03 **INSULATION**

A. Attachment of Insulation:
   1. Mechanically fasten insulation to deck in accordance with roofing manufacturer's instructions and Factory Mutual requirements.

B. Lay subsequent layers of insulation with joints staggered minimum 6 inch from joints of preceding layer.

C. Place tapered insulation to the required slope pattern in accordance with manufacturer's instructions.

D. On metal deck, place boards parallel to flutes with insulation board edges bearing on deck flutes.

E. Lay boards with edges in moderate contact without forcing, and gap between boards no greater than 1/4 inch. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.

F. Tape joints of insulation in accordance with roofing and insulation manufacturers' instructions.

G. At roof drains, use factory-tapered boards to slope down to roof drains over a distance of 24 inches.

H. Do not apply more insulation than can be completely waterproofed in the same day.

3.04 MEMBRANE APPLICATION

A. Roll out membrane, free from wrinkles or tears. Place sheet into place without stretching.

B. Shingle joints on sloped substrate in direction of drainage.

C. Fully Adhered Application: Apply adhesive to substrate and membrane at rate required by manufacturer. Fully embed membrane in adhesive except in areas directly over or within 3 inches of expansion joints. Fully adhere one roll before proceeding to adjacent rolls.
   1. Protect surface from discoloration from bonding adhesive.
   2. Do not place bonding adhesive containers or lids on membrane surface.

D. Seam Welding:
   1. Seam Welding: Overlap edges and ends and seal seams by heat welding, minimum 2 inches.
   2. Cover all seams with manufacturer's recommended joint covers.
   3. Probe all seams once welds have thoroughly cooled. (Approximately 30 minutes.)

4. Repair all deficient seams within the same day.
5. Seal cut edges of reinforced membrane after seam probe is complete.

E. At intersections with vertical surfaces:
1. Extend membrane over cant strips and up a minimum of 8 inches onto vertical surfaces.
2. Fully adhere flexible flashing over membrane and up to termination bar.

F. Install roofing expansion joints where indicated. Make joints watertight.

G. Install prefabricated joint components in accordance with manufacturer's instructions.

H. Coordinate installation of roof drains and sumps and related flashings.

I. Install walkway pads. Space pad joints to permit drainage.

3.05 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for general requirements for field quality control and inspection.

B. Require site attendance of roofing and insulation material manufacturers daily during installation of the Work.

3.06 CLEANING

A. See Section 01 74 19 - Construction Waste Management and Disposal, for additional requirements.

B. Remove bituminous markings from finished surfaces.

C. In areas where finished surfaces are soiled by work of this section, consult manufacturer of surfaces for cleaning advice and conform to their documented instructions.

D. Repair or replace defaced or damaged finishes caused by work of this section.

3.07 PROTECTION

A. Protect installed roofing and flashings from construction operations.

B. Where traffic must continue over finished roof membrane, protect surfaces using durable materials.

END OF SECTION

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SECTION 07 62 00
SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fabricated sheet metal items, including flashings, counterflashings, gutters, and downspouts.

B. Sealants for joints within sheet metal fabrications.

1.02 RELATED REQUIREMENTS

A. Section 01 74 19 – Construction Waste Management.

B. Section 01 81 13 – Sustainable Design Requirements.

C. Section 01 81 19 – Indoor Air Quality Requirements.

D. Section 04 20 00 - Unit Masonry: Metal flashings embedded in masonry.

E. Section 06 10 00 - Rough Carpentry: Wood nailers for sheet metal work.

F. Section 07 71 00 - Roof Specialties: Manufactured copings, flashings, and expansion joint covers.

G. Section 07 71 23 - Manufactured Gutters and Downspouts.

H. Section 07 72 00 - Roof Accessories: Manufactured metal roof curbs.

I. Section 07 92 00 - Joint Sealants: Sealing non-lap joints between sheet metal fabrications and adjacent construction.

1.03 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

B. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

C. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).

D. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

1.05 LEED REQUIREMENTS

A. LEED Focus Materials (LFMs) For This Section:
   1. Targeted products containing Recycled Content (MRc4)
   2. Targeted products containing Regional Material (MRc5)

1.06 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

C. Samples: Submit two samples 6 by 6 inch in size illustrating metal finish color.

D. LEED Product and Material Data Summary Form: For all installed products and materials of this Section, complete the "LEED Product and Material Data Summary Form" (attached to end of Section 01 81 13 - Sustainable Design Requirements)
   1. Product Material Cost: Provide the cost for material, or an assembled product, including taxes and delivery but excluding any cost for labor and equipment required for installation after the material is delivered to the site.
   2. Product Data for Credit MRc4, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating cost for each product having recycled content.
   3. Product Data for Credit MRc5, Regional Material: For products having regional materials, documentation indicating location of raw material extraction, harvest or recovery, as well as, manufacture (location of final assembly) within 500 miles of project site. Include statement indicating cost for each material or component of the assembled product.

1.07 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA (ASMM) requirements and standard details, except as otherwise indicated.

B. Maintain one copy of each document on site.

C. Fabricator and Installer Qualifications: Company specializing in sheet metal work with 5 years of documented experience.

D. Sustainability and LEED Standards Certification:
   1. Regional manufactured products with percentage by weight.
   2. Recycled content calculated as 1/2 preconsumer + postconsumer.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.01 SHEET MATERIALS

A. Stainless Steel: ASTM A666, Type 304 alloy, soft temper, 28 gage, (0.0156 inch) thick; smooth No. 4 - Brushed finish.

2.02 FLASHING TYPES

A. Flashing Type 1: 2-piece interlocking type:
   1. Material: Stainless steel.
   2. Configurations shall be as shown on drawings.
   3. Where cap flashings or counter flashings occur, they shall be of two-piece construction with a receiver having a special vertical locking slot that requires no malleting or bending to hold the insert member in place.
   4. Keyed or corrugated flashings are unacceptable.
   5. Fasteners, solder for sealing and attachment, etc., shall be as recommended by the manufacturer.
   6. Where flashings do not turn up behind walls, terminate with a 1/4" hook dam.

7. Thru-wall flashings at parapets shall be hemmed flush with the exposed face of face brick.
8. Fasteners, mastic for sealing and attachment, etc., shall be as recommended by the manufacturer.

B. Flashing Type 2: Masonry thru-wall type:
1. Stainless steel core flexible flashing with drainage fabric:
a. a. Product standard of quality: York Manufacturing, Inc.; York Flash-Vent SS,
b. b. Accepted products:
1) York Manufacturing, Inc.; York Flash-Vent SS, (www.yorkmfg.com)
2) STS Coatings, Inc.; Wall Guardian TWF Stainless Steel (www.stscoatings.com)
3) Building Materials West Company, Inc.; Evacu-Flash SS (www.evacu-flash.com)
2. Configurations shall be as shown on drawings.
3. Installation: Refer to Section 04 2000 - Unit Masonry.

C. Flashing Type 3: Membrane roofing base flashing material as specified in Section 07 53 00 - Elastomeric Membrane Roofing.

D. Flashing Type 4: Formed metal flashing (Other than Type 1):
1. Material: Stainless steel.
2. Configurations shall be as shown on drawings.

2.03 ACCESSORIES

A. Fasteners: Stainless steel, with soft neoprene washers.

B. Outside corner and inside corner material; manufacturer's standard available units using:
1. Stainless steel: 26 gauge stainless steel.

C. End dam: Product may be folded in line with the flashing material or utilize preformed end dams by manufacturer using:
1. Stainless steel: 26 gauge stainless steel

D. Protective Backing Paint: Asphaltic mastic, ASTM D4479 Type I.

E. Sealant to be Concealed in Completed Work: Type 3 as specified in Section 07 9200.

F. Sealant to be Exposed in Completed Work: Type 1 as specified in Section 07 9200.

G. Reglets: Surface mounted type, galvanized steel; face and ends covered with plastic tape.

H. Termination Bars: 1 inch wide x 1/8 inch thick; stainless steel.

2.04 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

B. Form pieces in longest possible lengths.

C. Hem exposed edges on underside 1/2 inch; miter and seam corners.

D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

E. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.

F. Fabricate vertical faces with bottom edge formed outward 3/4 inch and hemmed to form drip.

G. Fabricate flashings to allow toe to extend 2 inches over roofing gravel. Return and brake edges.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.

B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.02 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Install surface mounted reglets true to lines and levels, and seal top of reglets with sealant.

C. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

3.03 INSTALLATION

A. Conform to drawing details, and SMACNA Architectural Sheet Metal Manual.

B. Insert flashings into reglets to form tight fit; secure in place with plastic wedges; seal flashings into reglets with sealant.

C. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted..

D. Apply plastic cement compound between metal flashings and felt flashings.

E. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

F. Seal metal joints watertight.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for field inspection requirements.

B. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

END OF SECTION

SECTION 07 71 00
ROOF SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Manufactured roof specialties, including copings, fascias, and drip edges.

B. Roof expansion joint covers.

1.02 RELATED REQUIREMENTS

A. Section 07 72 00 - Roof Accessories: Manufactured curbs.

1.03 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2013.

B. ANSI/SPRI/FM 4435/ES-1 - Test Standard for Edge Systems Used with Low Slope Roofing Systems; 2017.

C. NRCA (RM) - The NRCA Roofing Manual; 2017.

1.04 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Product Data: Provide data on shape of components, materials and finishes, anchor types and locations.

C. Shop Drawings: Indicate configuration and dimension of components, adjacent construction, required clearances and tolerances, and other affected work.

D. Samples: Submit two appropriately sized samples of coping and expansion joint cover.

E. Manufacturer's Installation Instructions: Indicate special procedures, fasteners, supporting members, and perimeter conditions requiring special attention.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Roof Edge Flashings and Copings:
   1. W.P. Hickman Company: www.wph.com.
   2. Metal-Era Inc: www.metalera.com.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

B. Expansion Joint Covers:
   1. GAF: www.gaf.com/#sle.
   2. Johns Manville: www.jm.com.
   3. MM Systems Corp: www.mmsystemscorp.com.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

C. Pipe and Penetration Flashings:
   1. Portals Plus: www.portalsplus.com.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 COMPONENTS

A. Roof Edge Flashings: Factory fabricated to sizes required; mitered, welded corners; concealed fasteners.
   1. Configuration: Fascia, cant, and edge securement for roof membrane.
   2. Pull-Off Resistance: Tested in accordance with ANSI/SPRI/FM 4435/ES-1 using test methods RE-1 and RE-2 to positive and negative design wind pressure as defined by applicable local building code.
   3. Material: Formed aluminum sheet, 0.050 inch thick, minimum.
   4. Finish: 70 percent polyvinylidene fluoride.
   5. Color: To be selected by Architect from manufacturer's full range.
   6. Manufacturers:
      a. W.P. Hickman Company; Extruded TerminEdge: www.wph.com.
      b. Metal-Era Inc.: Anchor-Tite Extended Fascia.
      c. Substitutions: See Section 01 60 00 - Product Requirements.

B. Copings: Factory fabricated to sizes required; mitered, welded corners; concealed fasteners.
   1. Configuration: Concealed hold down cleat at both legs; internal splice piece at joints of same material, thickness and finish as cap; concealed stainless steel fasteners.
   2. Pull-Off Resistance: Tested in accordance with ANSI/SPRI/FM 4435/ES-1 using test method RE-3 to positive and negative design wind pressure as defined by applicable local building code.
   3. Material: Formed aluminum sheet, 0.050 inch thick, minimum.
   4. Finish: 70 percent polyvinylidene fluoride.
   5. Color: To be selected by Architect from manufacturer's standard range.
   6. Manufacturers:
      a. W.P. Hickman Company; PermaSnap 2 Coping: www.wph.com.
      b. Metal-Era Inc.: Anchor-Tite Extended Fascia.
      c. Substitutions: See Section 01 60 00 - Product Requirements.

C. Expansion Joint Covers: Composite construction of 6 inch wide flexible EPDM flashing of white color with closed cell urethane foam backing, each edge seamed to aluminum sheet metal flanges, designed for nominal joint width of 1 inch. Include special formed corners, tees, intersections, each sealed watertight.

2.03 ACCESSORIES

A. Sealant for Joints in Linear Components: As recommended by component manufacturer.

B. Adhesive for Anchoring to Roof Membrane: Compatible with roof membrane and approved by roof membrane manufacturer.

2.04 FINISHES

A. PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system; color as indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that deck, curbs, roof membrane, base flashing, and other items affecting work of this Section are in place and positioned correctly.

3.02 INSTALLATION

A. Install components in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.

B. Seal joints within components when required by component manufacturer.

C. Anchor components securely.

D. Coordinate installation of components of this section with installation of roofing membrane and base flashings.

E. Coordinate installation of sealants and roofing cement with work of this section to ensure water tightness.

END OF SECTION

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SECTION 07 72 00
ROOF ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Curbs.

B. Equipment rails.

C. Roof penetrations mounting curbs.

1.02 RELATED REQUIREMENTS

A. Section 07 71 00 - Roof Specialties: Other manufactured roof items.

1.03 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

C. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.04 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used.
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
   4. Maintenance requirements.

C. Shop Drawings: Submit detailed layout developed for this project and provide dimensioned location and number for each type of roof accessory.

D. Warranty Documentation:
   1. Submit manufacturer warranty.
   2. Ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store products under cover and elevated above grade.

1.06 WARRANTY

A. See Section 01 77 00 - Closeout Procedures, for additional warranty requirements.

B. Correct defective Work within a one year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 ROOF CURBS

A. Manufactured curbs, equipment rails, and other roof mounting assemblies: Factory-assembled hollow sheet metal construction with fully mitered and welded corners, integral counterflashing, internal reinforcing, and top side and edges formed to shed water.

1. Sheet Metal: Hot-dip zinc coated stell sheet complying with ASTM A653 / A653M, SS Grade 33; G90 coating designation; 18 gauge, 0.048 inch thick.
2. Manufacture curb bottom and mounting flanges for installation directly on roof deck, not on insulation; match slope and configuration of roof deck.
3. Provide the layouts and configurations indicated on the drawings.

B. Equipment Rail Curbs: Straight curbs on each side of equipment, with top of curbs horizontal and level with each other for equipment mounting.
   1. Height Above Finished Roof Surface: 8 inches, minimum.
   2. Height Above Roof Deck: 16 inches, minimum.

C. Pipe, Duct, or Conduit Mounting Curbs: Vertical posts, minimum 8 inches square unless otherwise indicated.
   1. Height Above Finished Roof Surface: 8 inches, minimum.
   2. Height Above Roof Deck: 16 inches, minimum.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using methods recommended by manufacturer for achieving acceptable results for applicable substrate under project conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions, in manner that maintains roofing system weather-tight integrity.

3.04 CLEANING

A. Clean installed work to like-new condition.

3.05 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 07 81 00
APPLIED FIREPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fireproofing of interior structural steel not exposed to damage or moisture.

B. Fireproofing of structural steel exposed to damage or moisture.

1.02 RELATED REQUIREMENTS

A. Section 01 74 19 – Construction Waste Management.

B. Section 01 81 13 – Sustainable Design Requirements.

C. Section 01 81 14 – Volatile Organic Compound (VOC) Limits For Adhesives, Sealants, Paints & Coatings.

D. Section 01 81 19 – Indoor Air Quality Requirements.

E. Section 05 12 00 - Structural Steel Framing.

F. Section 07 81 23 - Intumescent Mastic Fireproofing.

1.03 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.

B. ASTM E605/E605M - Standard Test Methods for Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members; 1993, with Editorial Revision (2015).

C. ASTM E736/E736M - Standard Test Method for Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members; 2017.

D. ASTM E760/E760M - Standard Test Method for Effect of Impact on Bonding of Sprayed Fire-Resistive Material Applied to Structural Members; 1992, with Editorial Revision (2015).

E. ASTM E859/E859M - Standard Test Method for Air Erosion of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members; 1993, with Editorial Revision (2015).

F. ASTM E937/E937M - Standard Test Method for Corrosion of Steel by Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members; 1993, with Editorial Revision (2015).

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with placement of ceiling hanger tabs, mechanical component hangers, and electrical components.

B. Preinstallation Meeting: Convene one week before starting work of this section.

1.05 LEED REQUIREMENTS

A. LEED Focus Materials (LFMs) For This Section:
   1. Targeted products containing Recycled Content (MRc4)
   2. Targeted products containing Regional Material (MRc5)
   3. Targeted products to meet VOC requirements (EQc4.1 & EQc4.2)

1.06 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittals procedures.

B. Test Reports: Reports from reputable independent testing agencies for proposed products, indicating compliance with specified criteria, conducted under conditions similar to those on project, for:
   1. Bond strength.
   2. Bond impact.
   3. Compressive strength.
   4. Fire tests using substrate materials similar those on project.

C. Manufacturer's Installation Instructions: Indicate special procedures.

D. Manufacturer's Certificate: Certify that sprayed-on fireproofing products meet or exceed requirements of contract documents.

E. LEED Product and Material Data Summary Form: For all installed products and materials of this Section, complete the “LEED Product and Material Data Summary Form” (attached to end of Section 01 81 13 - Sustainable Design Requirements)
   1. Product Material Cost: Provide the cost for material, or an assembled product, including taxes and delivery but excluding any cost for labor and equipment required for installation after the material is delivered to the site.
   2. Product Data for Credit MRc4, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating cost for each product having recycled content.
   3. Product Data for Credit MRc5, Regional Material: For products having regional materials, documentation indicating location of raw material extraction, harvest or recovery, as well as, manufacture (location of final assembly) within 500 miles of project site. Include statement indicating cost for each material or component of the assembled product.
   4. Product Data for Credit EQc4.1, Adhesives & Sealants: For adhesives and sealants, documentation including printed statement of VOC content and chemical components.
   5. Product Data for Credit EQc4.2, Paints & Coatings: For paints and coatings, documentation including printed statement of VOC content and chemical components.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified in this section, and:
   1. Approved by manufacturer.

C. Sustainability and LEED Standards Certification:
   1. Regional manufactured products with percentage by weight.
   2. Recycled content calculated as 1/2 preconsumer + postconsumer.
   3. VOC content limitations defined in Section 018114, "Volatile Organic Compound (VOC) Limits For Adhesives, Sealants, Paints, and Coatings."

1.08 FIELD CONDITIONS

A. Do not apply spray fireproofing when temperature of substrate material and surrounding air is below 40 degrees F or when temperature is predicted to be below said temperature for 24 hours after application.

B. Provide ventilation in areas to receive fireproofing during application and 24 hours afterward, to dry applied material.

C. Provide temporary enclosure to prevent spray from contaminating air.

1.09 WARRANTY

A. See Section 01 77 00 - Closeout Procedures, for additional warranty requirements.

B. Correct defective Work within a one (1) year period after Date of Substantial Completion.
   1. Include coverage for fireproofing to remain free from cracking, checking, dusting, flaking, spalling, separation, and blistering.
   2. Reinstall or repair failures that occur within warranty period.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Sprayed-On Fireproofing:
   1. Carboline Company: www.carboline.com
   2. GCP Applied Technologies: www.gcpat.com/#sle.
   3. Isolatek International Corp: www.isolatek.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 FIREPROOFING ASSEMBLIES

A. Provide assemblies as indicated on the drawings.

2.03 MATERIALS

A. Sprayed Fire-Resistive Material for Interior Applications, Concealed: Manufacturer's standard factory mixed material, which when combined with water is capable of providing the indicated fire resistance, and conforming to the following requirements:
   1. Composition: Portland cement-based; not mineral fiber-based.
   2. Bond Strength: 1000 pounds per square foot, minimum, when tested in accordance with ASTM E736/E736M when set and dry.
   3. Dry Density: 21 lb/cu ft, minimum, when tested in accordance with ASTM E605/E605M.
   4. Compressive Strength: 8.33 pounds per square inch, minimum.
   5. Effect of Impact on Bonding: No cracking, spalling or delamination, when tested in accordance with ASTM E760/E760M.
   6. Corrosivity: No evidence of corrosion, when tested in accordance with ASTM E937/E937M.
   7. Air Erosion Resistance: Weight loss of 0.025 g/sq ft, maximum, when tested in accordance with ASTM E859/E859M after 24 hours.
   8. Surface Burning Characteristics: Maximum flame spread index of 0 (zero) and maximum smoke developed index of 0 (zero), when tested in accordance with ASTM E84.
   9. Products:
      a. GCP Applied Technologies; Monokote Z-106 HY: www.gcpat.com/#sle..
      b. Carboline; Pyrocrete: www.carboline.com.
      c. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 ACCESSORIES

A. Primer Adhesive: Of type recommended by fireproofing manufacturer.

B. Metal Lath: Expanded metal lath; minimum 1.7 pounds per square foot, galvanized finish.

C. Water: Clean, potable.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive fireproofing.

B. Verify that clips, hangers, supports, sleeves, and other items required to penetrate fireproofing are in place.

C. Verify that ducts, piping, equipment, or other items that would interfere with application of fireproofing have not been installed.

D. Verify that voids and cracks in substrate have been filled. Verify that projections have been removed where fireproofing will be exposed to view as a finish material.

3.02 PREPARATION

A. Perform tests as recommended by fireproofing manufacturer in situations where adhesion of fireproofing to substrate is in question.

B. Remove incompatible materials that could affect bond by scraping, brushing, scrubbing, or sandblasting.

C. Prepare substrates to receive fireproofing in strict accordance with instructions of fireproofing manufacturer.

D. Protect surfaces not scheduled for fireproofing and equipment from damage by overspray, fall-out, and dusting.

E. Close off and seal duct work in areas where fireproofing is being applied.

3.03 APPLICATION

A. Install metal lath over structural members as indicated or as required by UL Assembly Design Numbers.

B. Apply primer adhesive in accordance with manufacturer's instructions.

C. Apply fireproofing in thickness and density necessary to achieve required ratings, with uniform density and texture.

D. Coordinate with intumescent fireproofing application for complete coverage.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Inspect the installed fireproofing after application and curing for integrity, prior to its concealment. Ensure that actual thicknesses, densities, and bond strengths meet requirements for specified ratings and requirements of the Authority Having Jurisdiction.

C. Re-inspect the installed fireproofing for integrity of fire protection, after installation of subsequent Work.

3.05 CLEANING

A. Remove excess material, overspray, droppings, and debris.

B. Remove fireproofing from materials and surfaces not required to be fireproofed.

END OF SECTION

SECTION 07 81 23
INTUMESCENT MASTIC FIREPROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Thin-film intumescent fire resistive coatings for exposed structural steel.

1.02 RELATED REQUIREMENTS

A. Section 01 74 19 – Construction Waste Management.

B. Section 01 81 13 – Sustainable Design Requirements.

C. Section 01 81 14 – Volatile Organic Compound (VOC) Limits For Adhesives, Sealants, Paints & Coatings.

D. Section 01 81 19 – Indoor Air Quality Requirements.

E. Section 05 12 00 - Structural Steel Framing.

F. Section 05 21 00 - Steel Joist Framing.

G. Section 07 81 00 - Applied Fireproofing: Conventional cementitious and mineral fiber fireproofing.

1.03 REFERENCE STANDARDS

A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2016a.

B. SSPC-PA 2 - Procedure For Determining Conformance To Dry Coating Thickness Requirements; 2015.

1.04 LEED REQUIREMENTS

A. LEED Focus Materials (LFMs) For This Section:
   1. Targeted products containing Recycled Content (MRc4)
   2. Targeted products containing Regional Material (MRc5)
   3. Targeted products to meet VOC requirements (EQc4.1 & EQc4.2)

1.05 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittals procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Performance characteristics and test results.
   2. Preparation instructions and recommendations.
   3. Storage and handling requirements and recommendations.
   4. Installation methods.

C. Test Reports: Published fire resistive designs for structural elements of the types required for the project, indicating hourly ratings of each assembly.

D. Certificates: Certify that intumescent fireproofing provided for this project meets or exceeds specified requirements in all respects.

E. LEED Product and Material Data Summary Form: For all installed products and materials of this Section, complete the “LEED Product and Material Data Summary Form” (attached to end of Section 01 81 13 - Sustainable Design Requirements)

1. Product Material Cost: Provide the cost for material, or an assembled product, including taxes and delivery but excluding any cost for labor and equipment required for installation after the material is delivered to the site.
2. Product Data for Credit MRc4, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating cost for each product having recycled content.
3. Product Data for Credit MRc5, Regional Material: For products having regional materials, documentation indicating location of raw material extraction, harvest or recovery, as well as, manufacture (location of final assembly) within 500 miles of project site. Include statement indicating cost for each material or component of the assembled product.
4. Product Data for Credit EQc4.1, Adhesives & Sealants: For adhesives and sealants, documentation including printed statement of VOC content and chemical components.
5. Product Data for Credit EQc4.2, Paints & Coatings: For paints and coatings, documentation including printed statement of VOC content and chemical components.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company that specializes in manufacturing the type of products specified, with minimum of 10 years of documented experience.

B. Installer Qualifications: Approved, certified, or supervised by manufacturer of intumescent fireproofing, with not less than 5 years of documented experience.

C. Sustainability and LEED Standards Certification:
   1. Regional manufactured products with percentage by weight.
   2. Recycled content calculated as 1/2 preconsumer + postconsumer.
   3. VOC content limitations defined in Section 018114, "Volatile Organic Compound (VOC) Limits For Adhesives, Sealants, Paints, and Coatings."

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer’s original, unopened containers with identification labels and testing agency markings intact and legible.

B. Store products in manufacturer's unopened packaging until ready for installation.
   1. Store at temperatures not less than 50 degrees F in dry, protected area.
   2. Protect from freezing, and do not store in direct sunlight.
   3. Dispose of any materials that have come into contact with contaminants of any kind prior to application.

C. Dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.08 FIELD CONDITIONS

A. Protect areas of application from windblown dust and rain.

B. Maintain ambient field conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under ambient conditions outside manufacturer's absolute limits.
   1. Provide temporary enclosures as required to control ambient conditions.
   2. Do not apply intumescent fireproofing when ambient temperatures are below 50 degrees F without specific approval from manufacturer.
   3. Maintain relative humidity between 40 and 60 percent in areas of application.

4. Maintain ventilation in enclosed spaces during application and for not less than 72 hours afterward.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Intumescent Fireproofing:
   1. Carboline Company; A/D Firefilm III: www.carboline.com
   2. Hilti, Inc; Fire Finish Steel Protection Spray CFP-SP WB: www.us.hilti.com/#sle.
   3. Isolatek International Corp; CAFCO SprayFilm WB3 (interior): www.isolatek.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 SYSTEM REQUIREMENTS

A. Fireproofing: Provide intumescent thin-film fire resistive coating systems tested by an independent testing agency in accordance with ASTM E119 and acceptable to authorities having jurisdiction (AHJ).

B. Structural Steel Columns: Fire resistance rating of 1 hour.

C. Structural Steel Beams: Fire resistance rating of 1 hour.

2.03 MATERIALS

A. Fire Resistive Coating System: Thin film intumescent coating system for the fire protection of structural steel.
   1. For Interior Use:
      a. Use only water-based products.
      b. Use only products without fiber content.
      c. Basis of Design: Carboline Company; FireFilm III.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

B. Protective and Decorative Top Coating: As recommended by fireproofing manufacturer for exposure conditions.
   1. Coordinate with paint specified in Section 09 90 00 for color and sheen match between steel coated with intumescent coating and adjacent painted surfaces.

C. Sealers and Primer: As required by tested and listed assemblies, and as recommended by fireproofing manufacturer to suit specific substrate conditions.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates to determine if they are in satisfactory condition to receive intumescent fireproofing. Verify that they are clean and free of oil, grease, incompatible primers, or other foreign substances capable of impairing bond to fireproofing system.

B. Do not begin installation until substrates have been properly prepared. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Thoroughly clean surfaces to receive fireproofing.

B. Repair substrates to remove surface imperfections that could affect uniformity of texture and thickness of fireproofing system. Remove minor projections and fill voids that could telegraph through the finished work.

C. Cover or otherwise protect other work that might be damaged by fallout or overspray of fireproofing system. Provide temporary enclosures as necessary to confine operations and maintain required ambient field conditions.

3.03 INSTALLATION

A. Comply with manufacturer's instructions for particular conditions of installation in each case.

B. Apply manufacturer’s recommended primer to required coating thickness.

C. Apply fireproofing to full thickness over entire area of each substrate to be protected. Apply coats at manufacturer’s recommended rate to achieve dry film thickness required for fire resistance ratings designated for each condition.

D. Apply intumescent fireproofing by spraying to maximum extent possible. If necessary, complete coverage by roller application or other method acceptable to manufacturer.

E. Achieve uniform finished appearance complying with approved mock-up.

3.04 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with Section 01 40 00 - Quality Requirements.

B. Arrange for testing of installed intumescent fireproofing by an independent testing laboratory using magnetic thickness gage, in accordance with SSPC-PA 2.
   1. Submit test reports promptly to Contractor and Architect.

C. Repair or replace fireproofing at locations where test results indicate fireproofing does not meet specified requirements.

3.05 CLEANING

A. Immediately after installation of fireproofing in each area, remove overspray and fallout from other surfaces and clean soiled areas.

3.06 PROTECTION

A. Protect installed intumescent fireproofing from damage due to subsequent construction activities, so fireproofing is without damage or deterioration before Date of Substantial Completion.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 07 84 00
FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Firestopping systems.

B. Firestopping of all joints and penetrations in fire resistance rated and smoke resistant assemblies, whether indicated on drawings or not, and other openings indicated.

1.02 RELATED REQUIREMENTS

A. Section 01 74 19 – Construction Waste Management.

B. Section 01 81 13 – Sustainable Design Requirements.

C. Section 01 81 14 – Volatile Organic Compound (VOC) Limits For Adhesives, Sealants, Paints & Coatings.

D. Section 01 81 19 – Indoor Air Quality Requirements.

E. Section 07 81 00 - Applied Fireproofing.

F. Section 09 21 16 - Gypsum Board Assemblies: Gypsum wallboard fireproofing.

1.03 REFERENCE STANDARDS

A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2016a.

B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2013a.

C. ASTM E1966 - Standard Test Method for Fire Resistive Joint Systems; 2007 (Reapproved 2011).

D. ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestops; 2014b.

E. ASTM E2393 - Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers; 2010a (Reapproved 2015).

F. ASTM E2307 - Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-story Test Apparatus; 2015b.

G. ASTM E2837 - Standard Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed Between Rated Wall Assemblies and Nonrated Horizontal Assemblies; 2013.

H. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015.

I. ITS (DIR) - Directory of Listed Products; current edition.

J. FM (AG) - FM Approval Guide; current edition.

K. UL 1479 - Standard for Fire Tests of Penetration Firestops; Current Edition, Including All Revisions.

L. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; Current Edition, Including All Revisions.

M. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

N. UL (FRD) - Fire Resistance Directory; current edition.

1.04 LEED REQUIREMENTS

A. LEED Focus Materials (LFMs) For This Section:
   1. Targeted products containing Recycled Content (MRc4)
   2. Targeted products containing Regional Material (MRc5)
   3. Targeted products to meet VOC requirements (EQc4.1 & EQc4.2)

1.05 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.

C. Product Data: Provide data on product characteristics, performance ratings, and limitations.

D. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. LEED Product and Material Data Summary Form: For all installed products and materials of this Section, complete the “LEED Product and Material Data Summary Form” (attached to end of Section 01 81 13 - Sustainable Design Requirements)
   1. Product Material Cost: Provide the cost for material, or an assembled product, including taxes and delivery but excluding any cost for labor and equipment required for installation after the material is delivered to the site.
   2. Product Data for Credit MRc4, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating cost for each product having recycled content.
   3. Product Data for Credit MRc5, Regional Material: For products having regional materials, documentation indicating location of raw material extraction, harvest or recovery, as well as, manufacture (location of final assembly) within 500 miles of project site. Include statement indicating cost for each material or component of the assembled product.
   4. Product Data for Credit EQc4.1, Adhesives & Sealants: For adhesives and sealants, documentation including printed statement of VOC content and chemical components.
   5. Product Data for Credit EQc4.2, Paints & Coatings: For paints and coatings, documentation including printed statement of VOC content and chemical components.

1.06 QUALITY ASSURANCE

A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
   1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.
   2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at www.icc-es.org will be considered as constituting an acceptable test report.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section and:
   1. Trained by manufacturer.
   2. Verification of minimum three years documented experience installing work of this type.

D. Sustainability and LEED Standards Certification:
   1. Regional manufactured products with percentage by weight.
   2. Recycled content calculated as 1/2 preconsumer + postconsumer.
   3. VOC content limitations defined in Section 018114, "Volatile Organic Compound (VOC) Limits For Adhesives, Sealants, Paints, and Coatings."

1.07 FIELD CONDITIONS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation. Maintain minimum temperature before, during, and for 3 days after installation of materials.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Firestopping Manufacturers:
   1. 3M Fire Protection Products: www.3m.com/firestop.
   2. Hilti, Inc: www.us.hilti.com/#sle.
   3. Nelson FireStop Products: www.nelsonfirestop.com.
   4. Specified Technologies Inc: www.stifirestop.com/#sle.
   5. International Fireproof Technology, Inc.; www.painttoprotect.com.
   6. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

A. Firestopping Materials: Any materials meeting requirements.

B. Mold and Mildew Resistance: Provide firestoppping materials with mold and mildew resistance rating of zero(0) in accordance with ASTM G21.

C. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.

D. Fire Ratings: Refer to drawings for required systems and ratings.

2.03 FIRESTOPPING ASSEMBLY REQUIREMENTS

A. General:
   1. Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.
   2. Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.

B. Perimeter Fire Containment Firestopping: Use any system that has been tested according to ASTM E2307 to have fire resistance F Rating equal to required fire rating of the floor assembly.
   1. Where floor assembly is not required to have a fire rating, provide systems that have been tested to show L Rating as indicated.

C. Head-of-Wall Joint System Firestopping at Joints Between Fire-Rated Wall Assemblies and Non-Rated Horizontal Assemblies: Use any system that has been tested according to ASTM

E2837 to have fire resistance F Rating equal to required fire rating of floor or wall, whichever is greater.

1. Movement: In addition, provide systems that have been tested to show movement capability as indicated.

D. Floor-to-Floor, Wall-to-Wall, and Wall-to-Floor Joints, Except Perimeter, Where Both Are Fire-Rated: Use any system that has been tested according to ASTM E1966 or UL 2079 to have fire resistance F Rating equal to required fire rating of the assembly in which the joint occurs.

1. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.

E. Through Penetration Firestopping: Use any system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.

1. Temperature Rise: In addition, provide systems that have been tested to show T Rating as indicated.
2. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.

2.04 FIRESTOPPING SYSTEMS

A. Firestopping: Any material meeting requirements.

1. Fire Ratings: Use any system that is listed by FM (AG), ITS (DIR), or UL (FRD) and tested in accordance with ASTM E814, ASTM E119, or UL 1479 with F Rating equal to fire rating of penetrated assembly and minimum T Rating Equal to F Rating and in compliance with other specified requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify openings are ready to receive the work of this section.

3.02 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter that could adversely affect bond of firestopping material.

B. Remove incompatible materials that could adversely affect bond.

C. Install backing materials to arrest liquid material leakage.

3.03 COORDINATION

A. Coordinate construction of openings, penetrations and construction joints to ensure that the fire stop systems area installed according to specified requirements.

B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration fire stop systems.

C. Coordinate construction and sizing of joints to ensure that fire-resistive joint systems are installed according to specified requirements.

D. Coordinate fire stopping with other trades so that obstructions are not placed in the way prior to the installation of the fire stop systems.

3.04 INSTALLATION

A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

B. Do not cover installed firestopping until inspected by authorities having jurisdiction.

C. Install labeling required by code.

3.05 FIELD QUALITY CONTROL

A. Independent Testing Agency: Inspection agency employed and paid by Owner, will examine penetration firestopping in accordance with ASTM E2174, and ASTM E2393.

B. Repair or replace penetration firestopping and joints at locations where inspection results indicate firestopping or joints do not meet specified requirements.

3.06 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.07 PROTECTION

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

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SECTION 07 92 00
JOINT SEALANTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nonsag gunnable joint sealants.

B. Self-leveling pourable joint sealants.

1.02 RELATED REQUIREMENTS

A. Section 01 74 19 – Construction Waste Management.

B. Section 01 81 13 – Sustainable Design Requirements.

C. Section 01 81 14 – Volatile Organic Compound (VOC) Limits For Adhesives, Sealants, Paints & Coatings.

D. Section 01 81 19 – Indoor Air Quality Requirements.

E. Section 07 13 00 - Sheet Waterproofing: Sealing cracks and joints in waterproofing substrate surfaces using materials specified in this section.

F. Section 07 25 00 - Weather Barriers: Sealants required in conjunction with air barriers and vapor retarders.

G. Section 07 84 00 - Firestopping: Firestopping sealants.

H. Section 08 71 00 - Door Hardware: Setting exterior door thresholds in sealant.

I. Section 08 80 00 - Glazing: Glazing sealants and accessories.

J. Section 09 21 16 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.

K. Section 09 22 16 - Non-Structural Metal Framing: Sealing between framing and adjacent construction in acoustical and sound-rated walls and ceilings.

L. Section 09 30 00 - Tiling: Sealant between tile and plumbing fixtures and at junctions with other materials and changes in plane.

1.03 REFERENCE STANDARDS

A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer; 2015.

B. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2012.

C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014a.

D. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.

E. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2008 (Reapproved 2012).

F. ASTM C1311 - Standard Specification for Solvent Release Sealants; 2014.

G. ASTM C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints; 2013.

H. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2015.

1.04 LEED REQUIREMENTS

A. LEED Focus Materials (LFMs) For This Section:
   1. Targeted products containing Recycled Content (MRc4)
   2. Targeted products containing Regional Material (MRc5)
   3. Targeted products to meet VOC requirements (EQc4.1 & EQc4.2)

1.05 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.
   1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
   2. List of backing materials approved for use with the specific product.
   3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
   4. Substrates the product should not be used on.

C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.

D. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

E. Samples for Verification: Where custom sealant color is specified, obtain directions from Architect and submit at least two physical samples for verification of color of each required sealant.

F. Preinstallation Field Adhesion Test Plan: Submit at least two weeks prior to start of installation.

G. Field Quality Control Plan: Submit at least two weeks prior to start of installation.

H. Preinstallation Field Adhesion Test Reports: Submit filled out Preinstallation Field Adhesion Test Reports log within 10 days after completion of tests; include bagged test samples and photographic records.

I. Field Quality Control Log: Submit filled out log for each length or instance of sealant installed, within 10 days after completion of inspections/tests; include bagged test samples and photographic records, if any.

J. LEED Product and Material Data Summary Form: For all installed products and materials of this Section, complete the “LEED Product and Material Data Summary Form” (attached to end of Section 01 81 13 - Sustainable Design Requirements)
   1. Product Material Cost: Provide the cost for material, or an assembled product, including taxes and delivery but excluding any cost for labor and equipment required for installation after the material is delivered to the site.
   2. Product Data for Credit MRc4, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating cost for each product having recycled content.
   3. Product Data for Credit MRc5, Regional Material: For products having regional materials, documentation indicating location of raw material extraction, harvest or

recovery, as well as, manufacture (location of final assembly) within 500 miles of project site. Include statement indicating cost for each material or component of the assembled product.

4. Product Data for Credit EQc4.1, Adhesives & Sealants: For adhesives and sealants, documentation including printed statement of VOC content and chemical components.
5. Product Data for Credit EQc4.2, Paints & Coatings: For paints and coatings, documentation including printed statement of VOC content and chemical components.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of documented experience.

C. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

D. Preinstallation Field Adhesion Test Plan: Include destructive field adhesion testing of one sample of each combination of sealant type and substrate, except interior acrylic latex sealants, and include the following for each tested sample.
   1. Identification of testing agency.
   2. Preinstallation Field Adhesion Test Log Form: Include the following data fields, with known information filled out.
      a. Test date.
      b. Copy of test method documents.
      c. Age of sealant upon date of testing.
      d. Test results, modeled after the sample form in the test method document.
      e. Indicate use of photographic record of test.

E. Field Quality Control Plan:
   1. Visual inspection of entire length of sealant joints.
   2. Non-destructive field adhesion testing of sealant joints, except interior acrylic latex sealants.
   3. Destructive field adhesion testing of sealant joints, except interior acrylic latex sealant.
      a. For each different sealant and substrate combination, allow for one test every 100 feet in the first 1000 linear feet, and one test per 1000 linear feet thereafter, or once per floor on each elevation.
      b. If any failures occur in the first 1000 linear feet, continue testing at frequency of one test per 500 linear feet at no extra cost to Owner.
   4. Field testing agency's qualifications.
   5. Field Quality Control Log Form: Show same data fields as on Preinstallation Field Adhesion Test Log, with known information filled out and lines for multiple tests per sealant/substrate combinations; include visual inspection and specified field testing; allow for possibility that more tests than minimum specified may be necessary.

F. Field Adhesion Test Procedures:
   1. Allow sealants to fully cure as recommended by manufacturer before testing.
   2. Have a copy of the test method document available during tests.

3. Record the type of failure that occurred, other information required by test method, and the information required on the Field Quality Control Log.
4. When performing destructive tests, also inspect the opened joint for proper installation characteristics recommended by manufacturer, and report any deficiencies.
5. Deliver the samples removed during destructive tests in separate sealed plastic bags, identified with project, location, test date, and test results, to Owner.
6. If any combination of sealant type and substrate does not show evidence of minimum adhesion or shows cohesion failure before minimum adhesion, report results to Architect.

G. Non-Destructive Field Adhesion Test: Test for adhesion in accordance with ASTM C1521, using Nondestructive Spot Method.

H. Destructive Field Adhesion Test: Test for adhesion in accordance with ASTM C1521, using Destructive Tail Procedure.
1. Sample: At least 18 inch long.
2. Minimum Elongation Without Adhesive Failure: Consider the tail at rest, not under any elongation stress; multiply the stated movement capability of the sealant in percent by two; then multiply 1 inch by that percentage; if adhesion failure occurs before the "1 inch mark" is that distance from the substrate, the test has failed.
3. If either adhesive or cohesive failure occurs prior to minimum elongation, take necessary measures to correct conditions and re-test; record each modification to products or installation procedures.

I. Sustainability and LEED Standards Certification:
1. Regional manufactured products with percentage by weight.
2. Recycled content calculated as 1/2 preconsumer + postconsumer.
3. VOC content limitations defined in Section 018114, "Volatile Organic Compound (VOC) Limits For Adhesives, Sealants, Paints, and Coatings."

1.07 WARRANTY

A. See Section 01 77 00 - Closeout Procedures, for additional warranty requirements.

B. Correct defective work within a five year period after Date of Substantial Completion.

C. Warranty: Include coverage for installed sealants and accessories that fail to achieve watertight seal , exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 SEALANT TYPE SCHEDULE:

Type 1	Non-Staining Silicone
Type 1A	Polyurethane
Type 2	Acrylic Emulsion Latex
Type 3	Non-Curing Butyl Sealant
Type 4	Fire resistant foam sealant: Refer to Section 07 84 00 - Firestopping
Type 5	Acrylic Emulsion Latex (Acoustic)
Type 6	Mildew-Resistant Silicone Sealant
Type 7	Self-leveling polyurea sealant

2.02 JOINT SEALANT APPLICATIONS

A. Scope:

1. Exterior Joints: Seal open joints, whether or not the joint is indicated on the drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items.
    a. Wall expansion and control joints.
    b. Joints between door, window, and other frames and adjacent construction.
    c. Joints between different exposed materials.
    d. Openings below ledge angles in masonry.
    e. Other joints indicated on drawings.
2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
    a. Joints between door, window, and other frames and adjacent construction.
    b. Joints between plubming fixtures and adjacent construction
    c. In sound-rated wall and ceiling assemblies, gaps at electrical outlets, wiring devices, piping, and other openings; between wall/ceiling and other construction; and other flanking sound paths.
    d. Joints between hollow metal door frames and resilient flooring.
    e. Joints between dissimilar exposed materials, unless otherwise indicated.
    f. Other joints indicated on drawings.
3. Do not seal the following types of joints.
    a. Intentional weepholes in masonry.
    b. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
    c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
    d. Joints where installation of sealant is specified in another section.
    e. Joints between suspended panel ceilings/grid and walls.

B. Exterior Joints: Use nonsag non-staining silicone sealant, Type 1, unless otherwise indicated.

C. Interior Joints: Use nonsag Acrylic emulsion latex sealant, Type 2, unless otherwise indicated.
1. Interior Expansion and Control Joints: Polyurethane sealant; Type 1A
2. Interior Joints at windows, storefront, and curtainwall: Polyurethane sealant; Type 1A
3. Fire-rated Construction: ASTM C 834, UL Listed
4. In Sound-Rated Assemblies: Acoustical sealant; Type 5.
5. Narrow Control Joints in Interior Concrete Slabs exposed to view: Self-leveling polyurea sealant; Type 7.
6. Interior Wet Areas, not expected to withstand continuous water immersion or traffic: Mildew-Resistant Silicone Sealant; Type 6

D. Definitions:
1. Interior Wet Areas: Bathrooms, restrooms, kitchens, food service areas, and food processing areas; fixtures in wet areas include plumbing fixtures, food service equipment, countertops, cabinets, and other similar items.
2. Sound-Rated Assemblies: Walls and ceilings identified as "STC-rated", "sound-rated", or "acoustical".

2.03 NONSAG JOINT SEALANTS

A. Type 1 - Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
   1. Movement Capability: Plus and minus 50 percent, minimum.
   2. Non-Staining To Porous Stone: Non-staining to light-colored natural stone when tested in accordance with ASTM C1248.
   3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
   4. Color: Custom color as selected by Architect.
   5. Cure Type: Single-component, neutral moisture curing.
   6. Manufacturers:
      a. Dow Chemical Company; 795 Silicone Building Sealant: consumer.dow.com/en-us/industry/ind-building-construction.html/#sle.
      b. Pecora Corporation; 890FTS Field Tintable Ultra Low Modulus Architectural Silicone Sealant - Class 100: www.pecora.com.
      c. Sika Corporation; Sikasil WS-295: www.usa-sika.com/#sle.
      d. Momentive Performance Materials, Inc (formerly GE Silicones); SilPruf NB SCS9000: www.siliconeforbuilding.com.
      e. Substitutions: See Section 01 60 00 - Product Requirements.

B. Type 1A - Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single component; not expected to withstand continuous water immersion or traffic.
   1. Movement Capability: Plus and minus 25 percent, minimum.
   2. Color: Match adjacent finished surfaces.
   3. Manufacturers:
      a. Pecora Corporation; DynaTrol 1-XL: www.pecora.com.
      b. Sika Corporation; Sikaflex-15 LM: www.usa-sika.com.
      c. Tremco Commercial Sealants & Waterproofing; Dymonic 100: www.tremcosealants.com/#sle.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

C. Type 2 - Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.
   1. Color: Standard colors matching finished surfaces, Type OP (opaque).
   2. Grade: ASTM C834; Grade - Minus 18 Degrees C.
   3. Manufacturers:
      a. Hilti, Inc; CP 506 Smoke and Acoustical Sealant: www.us.hilti.com/#sle.
      b. Pecora Corporation; AC-20 + Silicone Acrylic Latex Caulking Compound: www.pecora.com.
      c. Sherwin-Williams Company; White Lightning 3006 Siliconized Acrylic Latex Caulk: www.sherwin-williams.com.
      d. Tremco Global Sealants; Tremfles 834 Siliconized Acrylic Latex Selant: www.tremcosealants.com..
   4. Substitutions: See Section 01 60 00 - Product Requirements

D. Type 3 - Non-Curing Butyl Sealant: Solvent-based; ASTM C919; single component, nonsag, non-skinning, non-hardening, non-bleeding; vapor-impermeable; intended for fully concealed applications.

E. Type 4 - Fire resistant foam sealant: Refer to Section 07 84 00 - Firestopping.

F. Type 5 - Acoustical Sealant; Acrylic Emulsion Latex: Water-based; ASTM C 834, Type OP, Grade NF single component, paintable.
   1. Composition: Acrylic latex emulsion sealant.
   2. Manufacturers:
      a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant: www.pecora.com.
      b. Hilti, Inc.; CP 506 Smoke and Acoustical Sealant: www.us.hilti.com.
      c. USG Company; Sheetrock Brand Acoustical Sealant; www.usg.com.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

G. Type 6 - Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
   1. Color: White or Clear.
   2. Manufacturers:
      a. Pecora Corporation: www.pecora.com.
      b. Sika Corporation; Sikasil GP: www.usa-sika.com/#sle.
      c. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 SELF-LEVELING SEALANTS

A. Type 7 - Semi-Rigid Self-Leveling Polyurea Joint Filler: Two-component, 100 percent solids; Intended for filling cracks and control joints not subject to significant movement; rigid enough to support concrete edges under traffic.
   1. Hardness: 75, Shore A, minimum, when tested in accordance with ASTM D2240 after 7 days.
   2. Color: To be selected by Architect from manufacturer's standard colors.
   3. Joint Width, Minimum: 1/8 inch.
   4. Joint Width, Maximum: 3/4 inch.
   5. Joint Depth: Provide product suitable for joints from 1/8 inch to 1-1/2 inches in depth excluding space for backer rod.
   6. Manufacturers:
      a. Adhesives Technology Corporation; Crackbond JF-311: www.atcepoxy.com/#sle.
      b. Euclid Chemical Company; EUCO QWIKjoint UVR: www.euclidchemical.com/#sle.
      c. ARDEX Engineered Cements; ARDISEAL RAPID PLUS: www.ardexamericas.com.
      d. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joints are ready to receive work.

B. Verify that backing materials are compatible with sealants.

C. Preinstallation Adhesion Testing: Install a sample for each test location indicated in the test plan.
   1. Test each sample as specified in PART 1 under QUALITY ASSURANCE article.
   2. Notify Architect of date and time that tests will be performed, at least 7 days in advance.
   3. Record each test on Preinstallation Adhesion Test Log as indicated.

4. If any sample fails, review products and installation procedures, consult manufacturer, or take whatever other measures are necessary to ensure adhesion; re-test in a different location; if unable to obtain satisfactory adhesion, report to Architect.
5. After completion of tests, remove remaining sample material and prepare joint for new sealant installation.

3.02 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work.

E. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in inconspicuous area to verify that it does not stain or discolor slab.

3.03 INSTALLATION

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Perform installation in accordance with ASTM C1193.

C. Perform acoustical sealant application work in accordance with ASTM C919.

D. Measure joint dimensions and size joint backers to achieve the following, unless otherwise indicated:
   1. Width/depth ratio of 2:1.
      a. Minumim joint depth: 1/4 inch; Maximum joint depth: 1/2 inch, unless otherwise required by manufacturer.
   2. Neck dimension no greater than 1/3 of the joint width.
   3. Surface bond area on each side not less than 75 percent of joint width.

E. Install backer rod using blunt or rounded tool to a uniform (+/- 1/8 inch) depth without puncturing the material.

F. Install bond breaker backing tape where backer rod cannot be used.

G. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

H. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.

I. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

J. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.

3.04 FIELD QUALITY CONTROL

A. Perform field quality control inspection/testing as specified in PART 1 under QUALITY ASSURANCE article.

B. Non-Destructive Adhesion Testing: If there are any failures in first 100 linear feet, notify Architect immediately.

C. Destructive Adhesion Testing: If there are any failures in first 1000 linear feet, notify Architect immediately.

D. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

E. Repair destructive test location damage immediately after evaluation and recording of results.

3.05 POST-OCCUPANCY

A. Post-Occupancy Inspection: Perform visual inspection of entire length of project sealant joints at a time that joints have opened to their greatest width; i.e. at low temperature in thermal cycle. Report failures immediately and repair.

END OF SECTION

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SECTION 07 95 13
EXPANSION JOINT COVER ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Expansion joint cover assemblies for wall surfaces.

1.02 RELATED REQUIREMENTS

A. Section 04 20 00 - Unit Masonry: Placement of joint cover assembly frames in masonry.

B. Section 09 21 16 - Gypsum Board Assemblies: Placement of expansion joint assemblies in gypsum board walls and ceilings.

1.03 REFERENCE STANDARDS

A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

B. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.

C. ASTM B308/B308M - Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles; 2010.

D. ITS (DIR) - Directory of Listed Products; current edition.

E. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.04 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Product Data: Provide joint assembly profiles, profile dimensions, anchorage devices and available colors and finish.

C. Shop Drawings: Indicate joint and splice locations, miters, layout of the work, affected adjacent construction and anchorage locations.

D. Samples: Submit two samples 6 inches long, illustrating profile, dimension, color, and finish selected.

E. Manufacturer's Installation Instructions: Indicate rough-in sizes and required tolerances for item placement.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 for additional provisions.
   2. Extra Resilient Joint Filler: 20 ft length and any special tools required for installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Expansion Joint Cover Assemblies:
   1. Construction Specialties, Inc; (Basis of Design): www.c-sgroup.com.
   2. MM Systems Corp: www.mmsystemscorp.com.
   3. Emseal; www.emseal.com.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 EXPANSION JOINT COVER ASSEMBLIES

A. Expansion Joint Cover Assemblies - General: Factory-fabricated and assembled; designed to completely fill joint openings, sealed to prevent passage of air, dust, water, smoke; suitable for traffic expected.
   1. Joint Dimensions and Configurations: As indicated on drawings.
   2. Joint Cover Sizes: Selected to suit joint width and configuration, based on manufacturer's published recommendations and limitations.
   3. Lengths: Provide covers in full lengths required; avoid splicing wherever possible.
   4. Anchors, Fasteners, and Fittings: Provided by cover manufacturer.

2.03 MATERIALS

A. Seal Material: Silicone
   1. Color: As selected by Architect from manufacturer's standard range.

B. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper; or ASTM B308/B308M, 6061 alloy, T6 temper.
   1. Exposed Finish at Walls and Ceilings: Natural anodized.

C. Anchors and Fasteners: As recommended by cover manufacturer.

D. Threaded Fasteners: Stainless steel.

E. Backing Paint for Aluminum Components in Contact with Cementitious Materials: Asphaltic type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joint preparation and dimensions are acceptable and in accordance with manufacturer's requirements.

3.02 INSTALLATION

A. Install components and accessories in accordance with manufacturer's instructions.

B. Align work plumb and level, flush with adjacent surfaces.

C. Rigidly anchor to substrate to prevent misalignment.

END OF SECTION

SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Non-fire-rated hollow metal doors and frames.

B. Hollow metal frames for wood doors.

C. Fire-rated hollow metal doors and frames.

D. Thermally insulated hollow metal doors with frames.

E. Hollow metal borrowed lites glazing frames.

1.02 RELATED REQUIREMENTS

A. Section 01 74 19 – Construction Waste Management.

B. Section 01 81 13 – Sustainable Design Requirements.

C. Section 01 81 14 – Volatile Organic Compound (VOC) Limits For Adhesives, Sealants, Paints & Coatings.

D. Section 01 81 19 – Indoor Air Quality Requirements.

E. Section 08 71 00 - Door Hardware.

F. Section 08 80 00 - Glazing: Glass for doors and borrowed lites.

1.03 ABBREVIATIONS AND ACRONYMS

A. ANSI - American National Standards Institute.

B. HMMA - Hollow Metal Manufacturers Association.

C. NAAMM - National Association of Architectural Metal Manufacturers.

D. NFPA - National Fire Protection Association.

E. SDI - Steel Door Institute.

F. UL - Underwriters Laboratories.

1.04 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2011.

C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2014.

D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2011.

E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

F. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2016.

G. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2015.

H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.

I. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames; 2014.

J. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2009.

K. ITS (DIR) - Directory of Listed Products; current edition.

L. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.

M. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2011.

N. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames; 2007.

O. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; 2006.

P. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.

Q. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2012.

R. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames; 2013.

S. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

T. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.05 LEED REQUIREMENTS

A. LEED Focus Materials (LFMs) For This Section:
   1. Targeted products containing Recycled Content (MRc4)
   2. Targeted products containing Regional Material (MRc5)
   3. Targeted products to meet Composite Wood & Agrifiber requirements (EQc4.4)

1.06 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes.

C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

D. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.

E. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.

F. LEED Product and Material Data Summary Form: For all installed products and materials of this Section, complete the “LEED Product and Material Data Summary Form” (attached to end of Section 01 81 13 - Sustainable Design Requirements)
   1. Product Material Cost: Provide the cost for material, or an assembled product, including taxes and delivery but excluding any cost for labor and equipment required for installation after the material is delivered to the site.

2. Product Data for Credit MRc4, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating cost for each product having recycled content.
3. Product Data for Credit MRc5, Regional Material: For products having regional materials, documentation indicating location of raw material extraction, harvest or recovery, as well as, manufacture (location of final assembly) within 500 miles of project site. Include statement indicating cost for each material or component of the assembled product.
4. Product Data for Credit EQc4.4, Composite Wood & Agrifiber Products: Product data sheets, MSDS, certificates or letter from product manufacture highlighting that the composite wood or agrifiber product and/or associated laminating adhesive do not contain urea-formaldehyde resin.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years experience.

B. Maintain at project site copies of reference standards relating to installation of products specified.

C. Sustainability and LEED Standards Certification:
1. Regional manufactured products with percentage by weight.
2. Recycled content calculated as 1/2 preconsumer + postconsumer.
3. VOC content limitations defined in Section 018114, "Volatile Organic Compound (VOC) Limits For Adhesives, Sealants, Paints, and Coatings."
4. No Added Urea Formaldehyde in product.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hollow Metal Doors and Frames:
1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com.
2. De La Fontaine Inc: www.delafontaine.com.
3. Republic Doors: www.republicdoor.com.
4. Steelcraft, an Allegion brand: www.allegion.com/sle.
5. Technical Glass Products: www.tgpamerica.com/#sle.

2.02 DESIGN CRITERIA

A. Requirements for Hollow Metal Doors and Frames:
1. Steel used for fabrication of doors and frames shall comply with one or more of the following requirements; Galvannealed steel conforming to ASTM A653/A653M, cold-rolled steel conforming to ASTM A1008/A1008M, or hot-rolled pickled and oiled

(HRPO) steel conforming to ASTM A1011/A1011M, Commercial Steel (CS) Type B for each.

2. Accessibility: Comply with ICC A117.1 and ADA Standards.
3. Exterior Door Top Closures: Flush end closure channel, with top and door faces aligned.
4. Door Edge Profile: Beveled, both sides.
5. Typical Door Face Sheets: Flush.
6. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Manufacturers standard.
7. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
8. Zinc Coating for Typical Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvannealed) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.
    a. Based on SDI Standards: Provide at least A40/ZF120 (galvannealed) when necessary, coating not required for typical interior door applications, and at least A60/ZF180 (galvannealed) for corrosive locations.

B. Hollow Metal Panels: Same construction, performance, and finish as doors.

C. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.03 HOLLOW METAL DOORS

A. Exterior Doors: Thermally insulated.
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
    a. Level 3 - Extra Heavy-duty.
    b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
    c. Model 2 - Seamless.
    d. Door Face Metal Thickness: 16 gage, 0.053 inch, minimum.
    e. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M.
2. Door Core Material: Polyurethane, 1.8 lbs/cu ft minimum density.
    a. Foam Plastic Insulation: Manufacturer's standard board insulation with maximum flame spread index (FSI) of 75, and maximum smoke developed index (SDI) of 450 in accordance with ASTM E84, and completely enclosed within interior of door.
3. Door Thickness: 1-3/4 inch, nominal.
4. Weatherstripping: Refer to Section 08 71 00.
5. Door Finish: Factory primed and field finished.
6. Top and Bottom Closures: Flush with top of faces and edges.
7. Provide weep-hole openings in bottom of exterior doors to permit moisture to escape.

B. Interior Doors, Non-Fire Rated:
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
    a. Level 3 - Extra Heavy-duty.

b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
c. Model 2 - Seamless.
d. Door Face Metal Thickness: 16 gage, 0.053 inch, minimum.

2. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements.
3. Door Thickness: 1-3/4 inch, nominal.
4. Door Finish: Factory primed and field finished.
5. Top and Bottom Closures: Flush with top of faces and edges.

C. Fire-Rated Doors:
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
a. Level 3 - Extra Heavy-duty.
b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
c. Model 2 - Seamless.
d. Door Face Metal Thickness: 16 gage, 0.053 inch, minimum.
2. Fire Rating: As indicated on Door Schedule, tested in accordance with UL 10C and NFPA 252 ("positive pressure fire tests").
3. Temperature-Rise Rating (TRR) Across Door Thickness: In accordance with local building code and authorities having jurisdiction.
4. Provide units listed and labeled by UL (DIR) or ITS (DIR).
a. Attach fire rating label to each fire rated unit.
5. Door Core Material: Manufacturers standard core material/construction in compliance with requirements.
6. Door Thickness: 1-3/4 inch, nominal.
7. Door Finish: Factory primed and field finished.
8. Top and Bottom Closures: Flush with top of faces and eges.

2.04 HOLLOW METAL FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.

B. Frame Finish: Factory primed and field finished.

C. Exterior Door Frames: Full profile/continuously welded type.
1. Frame Metal Thickness: 14 gage, 0.067 inch, minimum.
2. Weatherstripping: Separate, see Section 08 71 00.

D. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.
1. Frame Metal Thickness: 16 gage, 0.053 inch, minimum.

E. Door Frames, Fire-Rated: Full profile/continuously welded type.
1. Fire Rating: Same as door, labeled.
2. Frame Metal Thickness: 16 gage, 0.053 inch, minimum.

F. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.

G. Mullions for Pairs of Doors: Removable type, with profile similar to jambs.

H. Borrowed Lites Glazing Frames: Construction and face dimensions to match door frames, and as indicated on drawings.

I. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.

J. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inch high to fill opening without cutting masonry units.

K. Frames Wider than 48 inches: Reinforce with steel channel fitted tightly into frame head, flush with top.

L. Frames Installed Back-to-Back: Reinforce with steel channels anchored to floor and overhead structure.

M. Provide kerfed stops for gasketing (UON). Note: Provide non-kerfed frames with integrated steel doors where gasket is by door manufacturer.
   1. Ceco Door: Series SQW Kerf frame.
   2. Steelcraft: F, MU, DW & K Series with integral kerfed frame.

2.05 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

2.06 ACCESSORIES

A. Glazing: As specified in Section 08 80 00, factory installed.

B. Removable Stops: Formed sheet steel, shape as indicated on drawings, butted corners; prepared for countersink style tamper proof screws.

C. Astragals for Double Doors:
   1. Fire-Rated Doors: Steel, shape as required for fire rating.

D. Grout for Frames: Portland cement grout with maximum 4 inch slump for hand troweling; thinner pumpable grout is prohibited.

E. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify that finished walls are in plane to ensure proper door alignment.

3.02 PREPARATION

A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

3.03 INSTALLATION

A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.

B. Install fire rated units in accordance with NFPA 80.

C. Coordinate frame anchor placement with wall construction.

D. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.

E. Install door hardware as specified in Section 08 71 00.

F. Comply with glazing installation requirements of Section 08 80 00.

G. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply touchup of compatible air drying, rust-inhibitive primer, zinc rich primer (exterior and galvanized openings) or finish paint.

3.04 TOLERANCES

A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.

1. Non-Fire-Rated Standard Steel Doors:

a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.

b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.

c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.

d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

B. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.05 ADJUSTING

A. Adjust for smooth and balanced door movement.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Test sound control doors for force to close, latch, and unlatch; adjust as necessary in compliance with requirements.

D. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable

3.06 SCHEDULE

A. Refer to Door and Frame Schedule on the drawings.

END OF SECTION

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SECTION 08 14 16
FLUSH WOOD DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Flush wood doors; flush configuration; fire-rated, non-rated, and acoustical.

1.02 RELATED REQUIREMENTS

A. Section 01 74 19 – Construction Waste Management.

B. Section 01 81 13 – Sustainable Design Requirements.

C. Section 01 81 14 – Volatile Organic Compound (VOC) Limits For Adhesives, Sealants, Paints & Coatings.

D. Section 01 81 19 – Indoor Air Quality Requirements.

E. Section 06 20 00 - Finish Carpentry: Installing wood doors.

F. Section 08 11 13 - Hollow Metal Doors and Frames.

G. Section 08 71 00 - Door Hardware.

H. Section 08 80 00 - Glazing.

1.03 REFERENCE STANDARDS

A. ANSI A135.4 - American National Standard for Basic Hardboard; 2012.

B. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).

C. ASTM E413 - Classification for Rating Sound Insulation; 2016.

D. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.

E. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.0; 2016.

F. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.

G. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2012.

H. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

I. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

J. UL 1784 - Standard for Air Leakage Tests of Door Assemblies; Current Edition, Including All Revisions.

K. WDMA I.S. 1A - Interior Architectural Wood Flush Doors; 2013.

1.04 LEED REQUIREMENTS

A. LEED Focus Materials (LFMs) For This Section:
   1. Targeted products containing Recycled Content (MRc4)
   2. Targeted products containing Regional Material (MRc5)
   3. Targeted products to meet Composite Wood & Agrifiber requirements (EQc4.4)

1.05 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.

C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.

D. Samples: Submit two samples of door construction, 12 by 12 inch in size cut from top corner of door.

E. Samples: Submit two samples of door veneer, 12 by 12 inch in size illustrating wood grain, stain color, and sheen.

F. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

G. Specimen warranty.

H. Test Reports: Show compliance with specified requirements for the following:
   1. Sound-retardant doors and frames; sealed panel tests are not acceptable.

I. Manufacturer's Installation Instructions: Indicate special installation instructions.

J. Warranty, executed in Owner's name.

K. LEED Product and Material Data Summary Form: For all installed products and materials of this Section, complete the “LEED Product and Material Data Summary Form” (attached to end of Section 01 81 13 - Sustainable Design Requirements)
   1. Product Material Cost: Provide the cost for material, or an assembled product, including taxes and delivery but excluding any cost for labor and equipment required for installation after the material is delivered to the site.
   2. Product Data for Credit MRc4, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating cost for each product having recycled content.
   3. Product Data for Credit MRc5, Regional Material: For products having regional materials, documentation indicating location of raw material extraction, harvest or recovery, as well as, manufacture (location of final assembly) within 500 miles of project site. Include statement indicating cost for each material or component of the assembled product.
   4. Product Data for Credit EQc4.4, Composite Wood & Agrifiber Products: Product data sheets, MSDS, certificates or letter from product manufacture highlighting that the composite wood or agrifiber product and/or associated laminating adhesive do not contain urea-formaldehyde resin.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.

C. Sustainability and LEED Standards Certification:

1. Regional manufactured products with percentage by weight.
2. Recycled content calculated as 1/2 preconsumer + postconsumer.
3. VOC content limitations defined in Section 018114, "Volatile Organic Compound (VOC) Limits For Adhesives, Sealants, Paints, and Coatings."
4. No Added Urea Formaldehyde in product.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Package, deliver and store doors in accordance with specified quality standard.

B. Accept doors on site in manufacturer's packaging. Inspect for damage.

C. Protect doors with resilient packaging sealed with heat shrunk plastic. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer if stored more than one week. Break seal on site to permit ventilation.

1.08 WARRANTY

A. See Section 01 77 00 - Closeout Procedures, for additional warranty requirements.

B. Interior Doors: Provide manufacturer's warranty for the life of the installation.

C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Wood Veneer Faced Doors:
1. Oshkosh Door Company: www.oshkoshdoor.com
2. Eggers Industries: www.eggersindustries.com.
3. Graham Wood Doors; "Premium" doors only: www.grahamdoors.com.
4. VT Industries: www.vtindustries.com
5. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 DOORS

A. Doors: Refer to drawings for locations and additional requirements.
1. Quality Standard: Premium Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS), AWMAC/WI (NAAWS) or WDMA I.S. 1A.
2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.

B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
1. Provide solid core doors at each location.
2. Fire Rated Doors: Tested to ratings indicated on drawings in accordance with UL 10C - Positive Pressure; Underwriters Laboratories Inc (UL) or Intertek/Warnock Hersey (WHI) labeled without any visible seals when door is open.
3. Smoke and Draft Control Doors: In addition to required fire rating, provide door assemblies tested in accordance with UL 1784 with maximum air leakage of 3.0 cfm per sq ft of door opening at 0.10 inch wg pressure at both ambient and elevated temperatures for "S" label.
4. Sound-Rated Doors: Minimum STC of 45, calculated in accordance with ASTM E413, tested in accordance with ASTM E90.
5. Wood veneer facing with factory transparent finish.

2.03 DOOR AND PANEL CORES

A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated.

B. Fire-Rated Doors: Mineral core type, with fire resistant composite core (FD), plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.

C. Sound-Resistant Doors: Equivalent to type, with particleboard core (PC) construction as required to achieve STC rating specified; plies and faces as indicated above.

2.04 DOOR FACINGS

A. Veneer Facing for Transparent Finish: White Maple, veneer grade in accordance with quality standard indicated, plain sliced (flat cut), with book match between leaves of veneer, running match of spliced veneer leaves assembled on door or panel face.
   1. Vertical Edges: Same species as face veneer.
   2. "Pair Match" each pair of doors; "Set Match" pairs of doors within 10 feet of each other when doors are closed.

B. Facing Adhesive: Type I - waterproof.

2.05 DOOR CONSTRUCTION

A. Fabricate doors in accordance with door quality standard specified.

B. Cores Constructed with stiles and rails:
   1. Provide solid blocks at lock edge for hardware reinforcement.
   2. Provide solid blocking for other throughbolted hardware.

C. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.

D. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.

E. Provide edge clearances in accordance with the quality standard specified.

2.06 FACTORY FINISHING - WOOD VENEER DOORS

A. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
   1. Transparent:
      a. System - 11, Polyurethane, Catalyzed.
      b. Stain: As selected by Architect.
      c. Sheen: Satin.

B. Factory finish doors in accordance with approved sample.

C. Seal door top edge with color sealer to match door facing.

2.07 ACCESSORIES

A. Hollow Metal Door Frames: As specified in Section 08 11 13.

B. Glazing: As specified in Section 08 80 00.

C. Glazing Stops: Wood, of same species as door facing, mitered corners; prepared for countersink style tamper proof screws.
   1. At fire-rated doors, veneer wrap fire-rated flush glazing bead with same species as door facing.

2. Where vision lite sizes exceed those tested for manufacturer's tested glazing bead, provide veneer-wrapped metal door lite frame by All Metal Stamping, Inc.: www.allmetalstamping.com, that meets opening requirements.
3. Verify that glazing stops do not interfere with mounting or operation of finish door hardware.

D. Door Hardware: As specified in Section 08 71 00.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

A. Install doors in accordance with manufacturer's instructions and specified quality standard.
1. Install fire-rated doors in accordance with NFPA 80 requirements.

B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.

C. Use machine tools to cut or drill for hardware.

D. Coordinate installation of doors with installation of frames and hardware.

E. Coordinate installation of glazing.

3.03 TOLERANCES

A. Conform to specified quality standard for fit and clearance tolerances.

B. Conform to specified quality standard for telegraphing, warp, and squareness.

3.04 ADJUSTING

A. Adjust doors for smooth and balanced door movement.

B. Adjust closers for full closure.

END OF SECTION

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SECTION 08 17 00
INTEGRATED DOOR OPENING ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Integrated metal door opening assemblies with doors, operating hardware, accessories, and installation for a complete assembly.

1.02 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. BHMA A156.3 - American National Standard for Exit Devices; 2014.

C. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames; 2014.

D. DHI (H&S) - Sequence and Format for the Hardware Schedule; 1996.

E. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.

F. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives; 2016.

G. NFPA 101 – Life Safety Code, National Fire Protection Association, 2012.

H. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2012.

I. UL 305 - Standard for Panic Hardware; Current Edition, Including All Revisions.

1.03 LEED REQUIREMENTS

A. LEED Focus Materials (LFMs) For This Section:
   1. Targeted products containing Recycled Content (MRc4)
   2. Targeted products containing Regional Material (MRc5)
   3. Targeted products to meet Composite Wood & Agrifiber requirements (EQc4.4)

1.04 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Product Data: Provide manufacturer's technical data sheets on each specified product.

C. Shop Drawings: Submit details of each door and frame condition; frame type, profile and installation details; finish hardware items, finishes and electrical rough-in requirements.

D. Door Hardware Schedule: Provided at end of section and containing detailed list of each hardware item to be provided on each integrated door opening; coordinate hardware furnished by others.

E. Certificate: Certify that products of this section meet or exceed specified requirements.

F. LEED Product and Material Data Summary Form: For all installed products and materials of this Section, complete the “LEED Product and Material Data Summary Form” (attached to end of Section 01 81 13 - Sustainable Design Requirements)
   1. Product Material Cost: Provide the cost for material, or an assembled product, including taxes and delivery but excluding any cost for labor and equipment required for installation after the material is delivered to the site.

2. Product Data for Credit MRc4, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating cost for each product having recycled content.
3. Product Data for Credit MRc5, Regional Material: For products having regional materials, documentation indicating location of raw material extraction, harvest or recovery, as well as, manufacture (location of final assembly) within 500 miles of project site. Include statement indicating cost for each material or component of the assembled product.
4. Product Data for Credit EQc4.4, Composite Wood & Agrifiber Products: Product data sheets, MSDS, certificates or letter from product manufacture highlighting that the composite wood or agrifiber product and/or associated laminating adhesive do not contain urea-formaldehyde resin.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with minimum three years of documented experience and approved by manufacturer (Secure Door and Hardware: www.securedoorandhardware.com).

C. Supplier Qualifications: Company specializing in supplying products specified in this section and authorized distributor of manufacturer (Secure Door and Hardware: www.securedoorandhardware.com).

D. Sustainability and LEED Standards Certification:
1. Regional manufactured products with percentage by weight.
2. Recycled content calculated as 1/2 preconsumer + postconsumer.
3. VOC content limitations defined in Section 018114, "Volatile Organic Compound (VOC) Limits For Adhesives, Sealants, Paints, and Coatings."
4. No Added Urea Formaldehyde in product.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Polyvinyl wrapped, placed on floor palette, and clearly marked for each opening.

B. Delivery: Deliver to site in original unopened containers and pallets bearing system manufacturer's name and brand.

C. Storage: Place horizontally on level surface, at least 2 inch above floor, in clean, dry, well-ventilated area protected from sunlight, extreme heat, dryness and moisture.
1. Store doors in a clear, dry ventilated space having controlled temperature and a relative humidity range between 30 and 60 percent. Stack doors flat and off the floor to prevent warpage.

D. Receiving, off-loading, and site distribution should be handled by an authorized Total Door Distributor unless otherwise stipulated by contract. If the G.C. or other entity handles all or any portion of the receiving, off-loading, and site distribution, they are held responsible for any and all damages that may result from potential miss handling of the product.

1.07 FIELD CONDITIONS

A. Maintain temperature, humidity, and ventilation environmental conditions within limits as recommended by manufacturer.

1. Do not install products when environmental conditions are outside manufacturer's recommended limits.

1.08 WARRANTY

A. See Section 01 77 00 - Closeout Procedures, for additional warranty requirements.

B. Warranty that integrated door opening assemblies, except as noted below, are free of defects in material or workmanship under normal use for a period of five (5) years from date of shipment from assembly plant facility.

C. Locksets, hanger rods, and panic exit devices: Manufacturer's lifetime limited warranty against defects in material and workmanship.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Integrated metal door systems
   1. Total Door: www.totaldoor.com.
   2. Substitutions: Not permitted.

B. Hardware
   1. Total Door: www.totaldoor.com.
   2. Substitutions: Not permitted.

2.02 MATERIALS

A. Frames
   1. To be supplied by others.
   2. In accordance with ANSI/SDI A250.8, SDI 111A, and SDI 112.
   3. Construction: All-welded unit, type.
   4. Material: Steel, cold rolled, ASTM A1008, 16 gauge.
   5. Fire Resistance Rating: Where indicated in Contract Documents for doors.
   6. Spreader Bar: Removable, at sill.

B. Frame Anchorage Devices
   1. To securely fasten to wall construction without distortion or stress.
   2. In accordance with fire resistance rating indicated in Contract Documents.

C. Door Systems
   1. In accordance with ANSI/SDI A250.8.
   2. General Use - Interior, Exterior & Fire Rated
      a. Stiles: Steel, galvannealed, 16 gauge, spot welded.
      b. Top and Bottom Rails: 5-1/2 inch 18 gauge steel rails.
      c. Cores:
         1) Solid polystyrene continuously bonded to faces.
         2) Temperature Rise.
      d. Thickness: 1-3/4 inches.
      e. Faces: Steel, stretcher leveled, without seams or spot welds, galvannealed 20 gauge.
      f. Weld pattern: Enhanced in accordance with manufactures standard details.
   3. Gasketing
      a. U.L. approved for fire doors.
      b. Jambs: Factory applied to latch/locking channels.

c. Floor: Factory Mortised Sweep. (must be ordered with elevator shaft & lobby applications)

2.03 FINISHES

A. Hinge and Locking Channel
1. Finish: Factory Pre-Finished.
a. Color to be selected by Architect.

B. Door Faces, Interior
1. Finish: As scheduled.

2.04 FABRICATION

A. Unless modified by Contract Documents, construct integrated metal door opening assemblies in accordance with manufacturer's published specifications and applicable Code requirements.

B. Factory assemble with full-height hinges and latching/locking channels, locksets, exit devices, closers, lite kits, glazing, kickplates, stretcher plates, and armor plates.

PART 3 EXECUTION

3.01 EXAMINATION

A. Prior to commencing this work, verify that existing conditions of related building components are acceptable for installing door systems and component assemblies.

B. Prior to fabrication of door systems, verify that opening sizes and tolerances are acceptable and in compliance with shop drawings.

C. Examine door opening assembly details with adjacent work to ensure proper attachments and connections are being provided for this work.

D. Report to Architect, in writing, conditions that would inhibit proper installation or compromise long-term durability of this work.

3.02 INSTALLATION

A. Install integrated door opening assemblies in accordance with manufacturer's instructions and specified requirements.

B. Install fire-rated units in accordance with NFPA 80.

C. Install smoke and draft control doors in accordance with NFPA 105.

D. Frame Assemblies: Set plumb, square, and properly prepared for hardware installation in compliance with BHMA A156.115.
1. Brace frame until adjacent wall is properly constructed.
2. Securely anchor frame to adjacent wall.
3. Provide clips, fasteners, and anchors as necessary and conceal unless otherwise noted.

E. Door Systems:
1. Hang to maintain manufacturer's installation tolerances.
2. Adjust to freely swing without binding, sticking or sagging, and to eliminate excessive clearances.

F. Coordinate installation of electrical connections to electrical hardware items.

3.03 ADJUSTING

A. Adjust door assembly and hardware for smooth and balanced door movement.

3.04 DOOR HARDWARE SCHEDULE

HARDWARE SET # 1 - 90 DEGREE HOLD OPEN

For use on Door Number(s): C113A, C117A, D140, ST1.2, ST4.1A, ST4.2.

UNITS	ITEM	DESCRIPTION	FINISH	MFR
2 ea	Full Height Hinges	H-13 Rigidized	TBD	TDS
2 ea	Full Height Latch Channel	L-11	TBD	TDS
2 ea	Operating Pulls	M33	628	TDS
2 ea	Exit Device/insert to match skin	PF200 (Flush Panic)	628	TDS
2 ea	Closer	TDC96	Alum	TDS
2 ea	Mag Holder	TDH100		TDS
2 ea	Positive Pressure label (confirm rating with door schedule)			TDS

HARDWARE SET # 2 - 180 DEGREE HOLD OPEN

For use on Door Number(s): ST1.1A.

UNITS	ITEM	DESCRIPTION	FINISH	MFR
2 ea	Full Height Hinges	H-13	TBD	TDS
2 ea	Full Height Latch Channel	L-11	TBD	TDS
2 ea	Operating Pulls	M33	628	TDS
2 ea	Exit Device/insert to match skin	PF200 (Flush Panic)	628	TDS
2 ea	Closer	TDCAFPKT	Alum	TDS
2 ea	Mag Holder	TDH100		TDS
2 ea	Positive Pressure label (confirm rating with door schedule)			TDS

HARDWARE SET # 3 - 90 DEGREE HOLD OPEN

For use on Door Number(s): ST2.1A, ST2.2, ST3.1A, ST3.2.

Provide the following for each Single door.

UNITS	ITEM	DESCRIPTION	FINISH	MFR
2 ea	Full Height Hinges	H-13 Rigidized	TBD	TDS
2 ea	Full Height Latch Channel	L-11	TBD	TDS
2 ea	Operating Pulls	M33	628	TDS
2 ea	Exit Device/insert to match skin	PF200 (Flush Panic)	628	TDS

2 ea	Closer	TDC96	Alum	TDS
2 ea	Mag Holder	TDH100		TDS
2 ea	Positive Pressure label (confirm rating with door schedule)			TDS

END OF SECTION

SECTION 08 36 13
SECTIONAL DOORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Glazed Aluminum Overhead sectional doors, manually operated.

B. Operating hardware, tracks, and supports.

1.02 RELATED REQUIREMENTS

1.03 REFERENCE STANDARDS

A. DASMA 102 - American National Standard Specifications for Sectional Overhead Type Doors; 2011.

1.04 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Shop Drawings: Indicate opening dimensions and required tolerances, connection details, anchorage spacing, hardware locations, and installation details.

C. Product Data: Show component construction, anchorage method, and hardware.

D. Manufacturer's Installation Instructions: Include any special procedures required by project conditions.

E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years documented experience.

1.06 WARRANTY

A. See Section 01 77 00 - Closeout Procedures for warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: Sectional Doors.
   1. Model 521 manufactured by Overhead Door.

B. Other Acceptable Manufacturers - Sectional Doors:
   1. C.H.I. Overhead Doors: www.chiohd.com/#sle.
   2. Clopay Building Products: www.clopaydoor.com/#sle.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 ALUMINUM DOOR COMPONENTS

A. Aluminum Doors: Flush aluminum, insulated; high lift operating style with track and hardware; complying with DASMA 102, Commercial application.
   1. Door Nominal Thickness: 2 inches thick.

2. Finish: Factory finished with acrylic baked enamel; color as selected from manufacturers standard line.
3. Glazed Lights: Full panel width, 3 row; set in place with security glazing stops.

B. Door Panels: Flush aluminum construction; outer aluminum sheet ___ inch thick; inner aluminum sheet ____ inch thick; flat profile; core reinforcement of ____ inch roll formed aluminum; rabbeted weather joints at meeting rails; insulated.

C. Glazing: Fully tempered glass; insulated; clear; 1/2 inch thick.

2.03 DOOR COMPONENTS

A. Hinge and Roller Assemblies: Heavy duty hinges and adjustable roller holders of galvanized steel; floating hardened steel bearing rollers, located at top and bottom of each panel, each side.

B. Lift Mechanism: Torsion spring on cross head shaft, with braided galvanized steel lifting cables.

C. Sill Weatherstripping: Resilient hollow rubber strip, one piece; fitted to bottom of door panel, full length contact.

D. Jamb Weatherstripping: Roll formed steel section full height of jamb, fitted with resilient weatherstripping, placed in moderate contact with door panels.

E. Head Weatherstripping: EPDM rubber seal, one piece full length.

F. Panel Joint Weatherstripping: Neoprene foam seal, one piece full length.

G. Lock: Inside side mounted, adjustable keeper, spring activated latch bar with feature to retain in locked or retracted position; interior handle.

H. Lock Cylinders: Master keyed to building keying system.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that wall openings are ready to receive work and opening dimensions and tolerances are within specified limits.

3.02 PREPARATION

A. Prepare opening to permit correct installation of door unit to perimeter air and vapor barrier seal.

B. Apply primer to wood frame.

3.03 INSTALLATION

A. Install door unit assembly in accordance with manufacturer's instructions.

B. Anchor assembly to wall construction and building framing without distortion or stress.

C. Securely brace door tracks suspended from structure. Secure tracks to structural members only.

D. Fit and align door assembly including hardware.

3.04 TOLERANCES

A. Maximum Variation from Plumb: 1/16 inch.

B. Maximum Variation from Level: 1/16 inch.

C. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch from 10 ft straight edge.

D. Maintain dimensional tolerances and alignment with adjacent work.

3.05 ADJUSTING

A. Adjust door assembly for smooth operation and full contact with weatherstripping.

3.06 CLEANING

A. Clean doors and frames and glazing.

B. Remove temporary labels and visible markings.

3.07 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

B. Do not permit construction traffic through overhead door openings after adjustment and cleaning.

END OF SECTION

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SECTION 08 43 13
ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum-framed storefront, with vision glass.

B. Infill panels of metal and glass.

C. Aluminum doors and frames.

D. Weatherstripping.

1.02 RELATED REQUIREMENTS

A. Section 01 74 19 – Construction Waste Management.

B. Section 01 81 13 – Sustainable Design Requirements.

C. Section 01 81 19 – Indoor Air Quality Requirements.

D. Section 07 92 00 - Joint Sealants: Sealing joints between frames and adjacent construction.

E. Section 08 71 00 - Door Hardware: Hardware items other than specified in this section.

F. Section 08 80 00 - Glazing: Glass and glazing accessories.

1.03 REFERENCE STANDARDS

A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; 2015.

B. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document); 2015.

C. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.

D. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2013.

E. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; 2010, with 2013 Supplements and Errata.

F. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

G. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.

H. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

I. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.

J. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).

K. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.

L. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2016).

1.04 LEED REQUIREMENTS

A. LEED Focus Materials (LFMs) For This Section:
   1. Targeted products containing Recycled Content (MRc4)
   2. Targeted products containing Regional Material (MRc5)

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with installation of other components that comprise the exterior enclosure.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.06 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, internal drainage details.

C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work, expansion and contraction joint location and details, and field welding required.

D. Samples: Submit two samples 12 by 12 inches in size illustrating finished aluminum surface, glass, infill panels, glazing materials.

E. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.

F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

G. LEED Product and Material Data Summary Form: For all installed products and materials of this Section, complete the “LEED Product and Material Data Summary Form” (attached to end of Section 01 81 13 - Sustainable Design Requirements)
   1. Product Material Cost: Provide the cost for material, or an assembled product, including taxes and delivery but excluding any cost for labor and equipment required for installation after the material is delivered to the site.
   2. Product Data for Credit MRc4, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating cost for each product having recycled content.
   3. Product Data for Credit MRc5, Regional Material: For products having regional materials, documentation indicating location of raw material extraction, harvest or recovery, as well as, manufacture (location of final assembly) within 500 miles of project site. Include statement indicating cost for each material or component of the assembled product.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

C. Sustainability and LEED Standards Certification:
   1. Regional manufactured products with percentage by weight.
   2. Recycled content calculated as 1/2 preconsumer + postconsumer.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Handle products of this section in accordance with AAMA CW-10.

B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.09 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

1.10 WARRANTY

A. See Section 01 77 00 - Closeout Procedures, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.

D. Provide twenty year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 BASIS OF DESIGN -- FRAMING FOR INSULATING GLAZING

A. Front-Set Style, Thermally-Broken:
   1. Basis of Design: Kawneer Company Inc.: Trifab VG 451T (Thermal) Framing System; www.kawneer.com.
   2. System Dimensions: 2 inches wide by 4-1/2 inches deep.

B. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed below:
   1. EFCO, a Pella Company: www.efcocorp.com/#sle.
   2. YKK AP America Inc: www.ykkap.com.
   3. Oldcastle Building Envelope: www.obe.com.

2.02 BASIS OF DESIGN -- FRAMING FOR MONOLITHIC GLAZING

A. Front-Set Style:
   1. Basis of Design: Kawneer Company Inc.: Trifab VG 451 (Non-Thermal) Framing System; www.kawneer.com.
   2. System Dimensions: 2 inches wide by 4-1/2 inches deep.

B. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed below:
   1. EFCO, a Pella Company: www.efcocorp.com/#sle.
   2. YKK AP America Inc: www.ykkap.com.
   3. Oldcastle Building Envelope: www.obe.com.

2.03 BASIS OF DESIGN -- SWINGING DOORS

A. Medium Stile, Monolithic Glazing:

1. Basis of Design: Kawneer Company Inc.; 350 Medium Stile Entrance.
2. The door stile and rail face dimensions of the entrance door will be as follows:
   a. Vertical Stile: 3-1/2 inches
   b. Top Rail: 3-1/2 inches
   c. Bottom Rail: 10 inches
3. Thickness: 1-3/4 inches.

B. Medium Stile, Insulating Glazing, Thermally-Broken:
1. Basis of Design: Kawneer Company Inc.; 360 Medium Stile Insulclad Thermal Entrance.
   a. Vertical Stile: 4-1/16 inches
   b. Top Rail: 4-1/16 inches
   c. Bottom Rail: 10 inches

C. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed below:
1. C.R. Laurence Company, Inc; U.S. Aluminum: www.crl-arch.com/sle.
2. EFCO, a Pella Company: www.efcocorp.com/#sle.
3. YKK AP America Inc: www.ykkap.com.

D. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 STOREFRONT

A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
1. Glazing Rabbet: For 1/4 inch monolithic glazing.
2. Finish: Class II natural anodized.
   a. Factory finish all surfaces that will be exposed in completed assemblies.
3. Finish Color: As selected by Architect from manufacturer's standard line.
4. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
5. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
6. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
7. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
8. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
9. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
10. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly, primarily in line with inside pane of glazing and inner sheet of infill panel and heel bead of glazing compound.

B. Performance Requirements:

1. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
   a. Design Wind Loads: Comply with requirements of ASCE 7.
   b. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
2. Water Penetration Resistance: No uncontrolled water on interior face, when tested in accordance with ASTM E331 at pressure differential of 8 psf.
3. Air Leakage: Maximum of 0.06 cu ft/min sq ft of wall area, when tested in accordance with ASTM E283 at 6.27 psf pressure differential across assembly.
4. Condensation Resistance Factor of Framing: 66, minimum, measured in accordance with AAMA 1503.
5. Overall U-value Including Glazing: 0.36 Btu/(hr sq ft deg F), maximum.

2.05 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, drainage holes and internal weep drainage system.
   1. Glazing Stops: Flush.

B. Glazing: As specified in Section 08 80 00.

C. Infill Panels: 20 gage (0.032) inch thick aluminum sheet.
   1. Finish: Same as storefront.

D. Swing Doors: Glazed aluminum.
   1. Thickness: 2 inches.
   2. Top Rail: 5 inches wide.
   3. Vertical Stiles: 5 inches wide.
   4. Bottom Rail: 10 inches wide.
   5. Glazing Stops: Square.
   6. Finish: Same as storefront.

2.06 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Sheet Aluminum: ASTM B209 (ASTM B209M).

C. Fasteners: Stainless steel.

D. Exposed Flashings: Aluminum sheet, 20 gage, 0.032 inch minimum thickness; finish to match framing members.

E. Concealed Flashings: Stainless steel, 26 gage, 0.0187 inch minimum thickness.

F. Sill Flashing Sealant: Elastomeric, silicone, compatible with flashing material.

G. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

2.07 FINISHES

A. Superior Performing Organic Coatings: AAMA 2605 multiple coat, thermally cured polyvinylidene fluoride (PVDF) system.

1. Polyvinylidene fluoride (PVDF) multi-coat thermoplastic fluoropolymer coating system, including minimum 70 percent PVDF color topcoat and minimum total dry film thickness of 0.9 mil; color and gloss as indicated on drawings.

2.08 HARDWARE

A. For each door, include weatherstripping, sill sweep strip, and threshold.

B. Other Door Hardware: As specified in Section 08 71 00.

C. Weatherstripping: Wool pile, continuous and replaceable; provide on all doors.

D. Sill Sweep Strips: Resilient seal type, of neoprene; provide on all doors.

E. Threshold: Extruded aluminum, one piece per door opening, ribbed surface; provide on all doors.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.

B. Verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

3.02 INSTALLATION

A. Install wall system in accordance with manufacturer's instructions.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.

G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.

H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

I. Set thresholds in bed of sealant and secure.

J. Install glass and infill panels in accordance with Section 08 80 00, using glazing method required to achieve performance criteria.

K. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inch per 3 feet non-cumulative or 0.06 inch per 10 feet, whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

3.04 ADJUSTING

A. Adjust operating hardware and sash for smooth operation.

3.05 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

C. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

3.06 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

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SECTION 08 44 13
GLAZED ALUMINUM CURTAIN WALLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum-framed curtain wall, with vision glazing and glass and metal infill panels.

B. Column covers.

1.02 RELATED REQUIREMENTS

A. Section 01 74 19 – Construction Waste Management.

B. Section 01 81 13 – Sustainable Design Requirements.

C. Section 01 81 19 – Indoor Air Quality Requirements.

D. Section 07 25 00 - Weather Barriers: Sealing framing to weather barrier installed on adjacent construction.

E. Section 07 92 00 - Joint Sealants: Sealing joints between frames and adjacent construction.

F. Section 08 80 00 - Glazing.

1.03 REFERENCE STANDARDS

A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; 2015.

B. AAMA 501.4 - Recommended Static Test Method for Evaluating Curtain Wall and Storefront Systems Subjected to Seismic and Wind Induced Interstory Drifts; 2009.

C. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document); 2015.

D. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.

E. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2013.

F. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; 2010, with 2013 Supplements and Errata.

G. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

H. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.

I. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

J. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.

K. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).

L. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2016).

M. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference; 2015.

1.04 LEED REQUIREMENTS

A. LEED Focus Materials (LFMs) For This Section:
   1. Targeted products containing Recycled Content (MRc4)
   2. Targeted products containing Regional Material (MRc5)

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordinate with installation of other components that comprise the exterior enclosure.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.06 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, internal drainage details, glazing, and infill.

C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work, expansion and contraction joint location and details, and field welding required.

D. Samples: Submit two samples 12 by 12 inches in size illustrating finished aluminum surface, glazing, infill panels, and glazing materials.

E. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.

F. Field Quality Control Submittals: Report of field testing for water leakage.

G. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

H. LEED Product and Material Data Summary Form: For all installed products and materials of this Section, complete the “LEED Product and Material Data Summary Form” (attached to end of Section 01 81 13 - Sustainable Design Requirements)
   1. Product Material Cost: Provide the cost for material, or an assembled product, including taxes and delivery but excluding any cost for labor and equipment required for installation after the material is delivered to the site.
   2. Product Data for Credit MRc4, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating cost for each product having recycled content.
   3. Product Data for Credit MRc5, Regional Material: For products having regional materials, documentation indicating location of raw material extraction, harvest or recovery, as well as, manufacture (location of final assembly) within 500 miles of project site. Include statement indicating cost for each material or component of the assembled product.

1.07 QUALITY ASSURANCE

A. Designer Qualifications: Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed at the State in which the Project is located.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with not less than three years of documented experience.

C. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

D. Sustainability and LEED Standards Certification:
   1. Regional manufactured products with percentage by weight.
   2. Recycled content calculated as 1/2 preconsumer + postconsumer.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Handle products of this section in accordance with AAMA CW-10.

B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.09 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

1.10 WARRANTY

A. See Section 01 77 00 - Closeout Procedures, for additional warranty requirements.

B. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.

C. Provide 20 year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 BASIS OF DESIGN

A. Pressure Cap at Four Sides; Unitized and Thermally Enhanced:
   1. Basis of Design: Kawneer Company Inc.; 1620 Curtain Wall System: www.kawneer.com.
      a. Frame depth: 2 inch x 6 inch, outside glazed pressure plate.

B. Other Manufacturers: Provide either product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed below.
   1. EFCO, a Pella Company: www.efcocorp.com/#sle.
   2. Wausau Window and Wall Systems: www.wausauwindow.com.
   3. YKK AP America Inc: www.ykkap.com.

C. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 CURTAIN WALL

A. Aluminum-Framed Curtain Wall: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
   1. Finish: Superior performing organic coatings.

a. Factory finish surfaces that will be exposed in completed assemblies.
b. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.
c. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.

2. Provide flush joints and corners, weathersealed, accurately fitted and secured; prepared to receive anchors; fasteners and attachments concealed from view; reinforced as required for imposed loads.
3. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
4. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
5. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly, primarily in line with inside pane of glazing and inner sheet of infill panel and heel bead of glazing compound.
6. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
7. Preparation for Window Treatments: Provide reinforced interior horizontal head rail.

B. Structural Performance Requirements: Design and size components to withstand the following load requirements without damage or permanent set.
1. Design Wind Loads: Comply with the requirements of ASCE 7.
2. Seismic Loads: Design and size components to withstand seismic loads and sway displacement in accordance with requirements of ASCE 7.
3. Interstory Differential Lateral Movement: Meeting pass/fail criteria of AAMA 501.4 for Use Group I, Standard Occupancy, when tested at design displacement of 0.010 times greater adjacent story height, maximum, and 1.5 times design displacement, through three complete cycles.
4. Movement: Accommodate the following movement without damage to components or deterioration of seals:
a. Expansion and contraction caused by 180 degrees F surface temperature.
b. Expansion and contraction caused by cycling temperature range of 170 degrees F over a 12 hour period.
c. Movement of curtain wall relative to perimeter framing.
d. Deflection of structural support framing, under permanent and dynamic loads.

C. Water Penetration Resistance: No uncontrolled water on indoor face when tested as follows:
1. Test Pressure Differential: 12 psf.
2. Test Method: ASTM E331.

D. Air Leakage: Maximum of 0.06 cu ft/min sq ft of wall area, when tested in accordance with ASTM E283 at 6.27 psf pressure differential across assembly.

E. Thermal Performance Requirements:
1. Condensation Resistance Factor of Framing: 70, minimum, measured in accordance with AAMA 1503.
2. Overall U-value Including Glazing: 0.41 Btu/(hr sq ft deg F), maximum.

2.03 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.

B. Glazing: As specified in Section 08 80 00.

C. Infill Panels: Insulated, aluminum sheet face and back, with edges formed to fit glazing channel and sealed.
   1. Substrate: High density tempered harboard and impact resistant layer.
   2. Core: Rigid polyisocyanurate insulation
   3. Interior and Exterior Finish: superior performance organic coating, custom color to match architecs sample.
   4. Manufacturers: Mapes Industries, Inc.

D. Column Covers: Aluminum, 10 gage, 0.125 inch minimum thickness, finish to match curtain wall framing members.
   1. Location: Columns at Stair 4

2.04 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Sheet Aluminum: ASTM B209 (ASTM B209M).

C. Fasteners: Stainless steel; type as required or recommended by curtain wall manufacturer.

D. Perimeter Sealant: Type 1 specified in Section 07 92 00

E. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

F. Glazing Accessories: As specified in Section 08 80 00.

2.05 FINISHES

A. Superior Performing Organic Coatings: AAMA 2605 multiple coat, thermally cured polyvinylidene fluoride system.
   1. Polyvinylidene fluoride (PVDF) multi-coat thermoplastic fluoropolymer coating system, including minimum 70 percent PVDF color topcoat and minimum total dry film thickness of 0.9 mil; color and gloss as indicated on drawings.

B. Color: To be selected by Architect from manufacturer's full range.

C. Touch-Up Materials: As recommended by coating manufacturer for field application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other related work.

B. Verify that curtain wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

C. Verify that anchorage devices have been properly installed and located.

3.02 INSTALLATION

A. Install curtain wall system in accordance with manufacturer's instructions.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.

G. Pressure Plate Framing: Install glazing and infill panels in accordance with Section 08 80 00, using exterior dry glazing method.

H. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

I. Provide low-expansion foam insulation in shim spaces at perimeter of assembly to maintain continuity of thermal and air barrier.

3.03 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inches every 3 ft non-cumulative or 0.5 inches per 100 ft, whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

C. Sealant Space Between Curtain Wall Mullions and Adjacent Construction: Maximum of 3/4 inch and minimum of 1/4 inch.

3.04 FIELD QUALITY CONTROL

A. Provide services of manufacturer's field representative to observe installation and submit report.

B. Test installed curtain wall for water leakage in accordance with ASTM E1105 with a uniform test pressure difference of 2.86 lbs per sq ft.
   1. If window fails, perform additional tests at contractor's expense.
   2. Upon successful completion of testing, curtain wall may remain in place.

C. Replace curtain wall components that have failed field testing and retest until performance is satisfactory.

3.05 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

C. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

3.06 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

SECTION 08 51 13
ALUMINUM WINDOWS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Extruded aluminum windows with fixed sash, operating sash, and infill panels.

B. Factory glazing.

C. Operating hardware.

1.02 RELATED REQUIREMENTS

A. Section 01 74 19 – Construction Waste Management.

B. Section 01 81 13 – Sustainable Design Requirements.

C. Section 01 81 19 – Indoor Air Quality Requirements.

D. Section 07 92 00 - Joint Sealants: Sealing joints between window frames and adjacent construction.

E. Section 08 80 00 - Glazing.

1.03 REFERENCE STANDARDS

A. AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/Specification for windows, doors, and skylights; 2011.

B. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; 2015.

C. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document); 2015.

D. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2013.

E. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

F. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.

G. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

H. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.

I. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).

J. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2016).

K. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference; 2015.

1.04 LEED REQUIREMENTS

A. LEED Focus Materials (LFMs) For This Section:
   1. Targeted products containing Recycled Content (MRc4)
   2. Targeted products containing Regional Material (MRc5)

1.05 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

1.06 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Product Data: Provide component dimensions, information on glass and glazing, internal drainage details, and descriptions of hardware and accessories.

C. Shop Drawings: Indicate opening dimensions, elevations of different types, framed opening tolerances, method for achieving air and vapor barrier seal to adjacent construction, anchorage locations, custom panning profiles, and installation requirements.

D. Samples: Submit two samples, 12 by 12 inch in size illustrating typical corner construction, accessories, and finishes.

E. Grade Substantiation: Prior to submitting shop drawings or starting fabrication, submit one of the following showing compliance with specified grade:
   1. Evidence of AAMA Certification.
   2. Evidence of WDMA Certification.
   3. Evidence of CSA Certification.
   4. Test report(s) by independent testing agency itemizing compliance and acceptable to authorities having jurisdiction.

F. Test Reports: Prior to submitting shop drawings or starting fabrication, submit test report(s) by independent testing agency showing compliance with performance requirements in excess of those prescribed by specified grade.

G. Manufacturer's Installation Instructions: Include complete preparation, installation, and cleaning requirements.

H. LEED Product and Material Data Summary Form: For all installed products and materials of this Section, complete the “LEED Product and Material Data Summary Form” (attached to end of Section 01 81 13 - Sustainable Design Requirements)
   1. Product Material Cost: Provide the cost for material, or an assembled product, including taxes and delivery but excluding any cost for labor and equipment required for installation after the material is delivered to the site.
   2. Product Data for Credit MRc4, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating cost for each product having recycled content.
   3. Product Data for Credit MRc5, Regional Material: For products having regional materials, documentation indicating location of raw material extraction, harvest or recovery, as well as, manufacture (location of final assembly) within 500 miles of project site. Include statement indicating cost for each material or component of the assembled product.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

C. Sustainability and LEED Standards Certification:
   1. Regional manufactured products with percentage by weight.
   2. Recycled content calculated as 1/2 preconsumer + postconsumer.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of AAMA CW-10.

B. Protect finished surfaces with wrapping paper or strippable coating during installation. Do not use adhesive papers or sprayed coatings that bond to substrate when exposed to sunlight or weather.

1.09 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F.

B. Maintain this minimum temperature during and 24 hours after installation of sealants.

1.10 WARRANTY

A. See Section 01 77 00 - Closeout Procedures, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Provide 10 year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.

D. Provide 20 year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 BASIS OF DESIGN - AW PERFORMANCE CLASS WINDOWS

A. Grade: AAMA/WDMA/CSA 101/I.S.2/A440 having Performance Class of AW, and Performance Grade at least as high as specified design pressure.

B. Projected, Face of Sash and Frame in Approximately Same Plane:
   1. Basis of Design: Traco TR-2000 Series; TR-2400 Projected Flush Project In (hopper), TR-2500 Projected Flush Project Out (awning), and TR-2800 Fixed.

C. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of one of the manufacturers listed below:
   1. EFCO, a Pella Company; Model 550 I: www.efcocorp.com/#sle.
   2. YKK AP America Inc: www.ykkap.com.
   3. Winco; Model Series 1150 Thermal AW80.

D. Substitutions: See Section 01 60 00 - Product Requirements.
   1. For any product not identified as "Basis of Design", submit information as specified for substitutions.

2.02 WINDOWS

A. Aluminum Windows: Extruded aluminum frame and sash, factory fabricated, factory finished, with operating hardware, related flashings, and anchorage and attachment devices.
   1. Provide units factory glazed.
   2. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors; fasteners and attachments concealed from view; reinforced as required for operating hardware and imposed loads.
   3. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
   4. Movement: Accommodate movement between window and perimeter framing and deflection of lintel, without damage to components or deterioration of seals.
   5. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
   6. Thermal Movement: Design to accommodate thermal movement caused by 180 degrees F surface temperature without buckling stress on glass, joint seal failure, damaging loads on structural elements, damaging loads on fasteners, reduction in performance or other detrimental effects.

B. Performance Requirements: Provide products that comply with the following:
   1. Design Pressure (DP): In accordance with applicable codes.
   2. Water Leakage: No uncontrolled leakage on interior face when tested in accordance with ASTM E331 at differential pressure of 12.11 psf.
   3. Air Leakage: Maximum of 0.1 cu ft/min sq ft per unit area of outside frame dimension, with 6.27 psf differential pressure when tested in accordance with ASTM E283.
   4. Overall U-value, Including Glazing: 0.35, maximum, measured on the window size required for this project.

2.03 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Sheet Aluminum: ASTM B209 (ASTM B209M).

2.04 HARDWARE

A. For each in-swinging window, furnish manufacturer’s standard-finish cam handles, continuous aluminum hinge, and stainless steel support arms.

B. Provide concealed limit device on all operable units to restrict opening width to 6” maximum.

2.05 FINISHES

A. Superior Performing Organic Coatings: AAMA 2605 multiple coat, thermally cured polyvinylidene fluoride system.
   1. Polyvinylidene fluoride (PVDF) multi-coat thermoplastic fluoropolymer coating system, including minimum 70 percent PVDF color topcoat and minimum total dry film thickness of 0.9 mil; color and gloss as selected from manufacturer’s standard line.

B. Finish Color: As selected by Architect from manufacturer'sfull range.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that wall openings and adjoining air and vapor seal materials are ready to receive aluminum windows.

3.02 INSTALLATION

A. Install windows in accordance with manufacturer's instructions.

B. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities.

C. Align window plumb and level, free of warp or twist. Maintain dimensional tolerances and alignment with adjacent work.

D. Install sill and sill end angles.

E. Provide thermal isolation where components penetrate or disrupt building insulation. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

F. Install operating hardware not pre-installed by manufacturer.

G. Install glass and infill panels in accordance with requirements specified in Section 08 80 00.

3.03 TOLERANCES

A. Maximum Variation from Level or Plumb: 1/16 inches every 3 ft non-cumulative or 1/8 inches per 10 ft, whichever is less.

3.04 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Upon Owner's request, provide manufacturer's field service consisting of product use recommendations and periodic site visit for inspection of product installation in accordance with manufacturer's instructions.

B. Field Test: At Owner’s request, conduct field test to determine water tightness of window system. Conduct test in accordance with NAAMM FC-1-76 at locations selected by Architect. If required, contractor shall be compensated for this testing.

3.05 ADJUSTING

A. Adjust hardware for smooth operation and secure weathertight closure.

3.06 CLEANING

A. Remove protective material from factory finished aluminum surfaces.

B. Wash surfaces by method recommended and acceptable to window manufacturer; rinse and wipe surfaces clean.

C. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

D. Remove excess glazing sealant by moderate use of mineral spirits or other solvent acceptable to sealant and window manufacturer.

END OF SECTION

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SECTION 08 62 50
TUBULAR DAYLIGHTING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tubular daylighting devices and accessories.

1.02 RELATED SECTIONS

A. Section 06 10 00 - Wood Framing; Site built wood curbs and nailers.

B. Section 07 53 00 - Electrometric Membrane Roofing: Flashing of skylight base.

C. Section 07 62 00 - Flashing and Sheet Metal: Metal curb flashings.

1.03 REFERENCES

A. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

B. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

C. ASTM A 463/A 463M - Standard Specification for Steel Sheet, Aluminum Coated, by the Hot Dip Process.

D. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc Coated (Galvanized), by the Hot Dip Process.

E. ASTM A 792/A 792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.

F. ASTM E 108 - Standard Test Methods for Fire Tests of Roof Coverings.

G. ASTM E 283 - Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

H. ASTM E 308 - Standard Practice for Computing the Colors of Objects by Using the CIE System.

I. ASTM E 330 - Structural Performance of Exterior Windows, Curtain Walls and Doors.

J. ASTM E 547 - Test Method for Water Penetration of Exterior Windows, Skylights, Doors and Curtain walls by Cyclic Air Pressure Difference.

K. ASTM E 1886 - Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials.

L. ASTM E 1996 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricane.

M. ASTM D 635 - Test Method for Rate of Burning and/or Extent of Time of Burning of Self-Supporting Plastics in a Horizontal Position.

N. ASTM D 1929 - Test Method for Ignition Properties of Plastics.

O. ASTM D 2843 - Standard Test Method for Density of Smoke from the Burning or Decomposition of Plastics.

P. ASTM F 1642 - Standard Test Method for Glazing and Glazing Systems Subject to Airblast Loading.

Q. ASTM F 2912 - Standard Specification for Glazing and Glazing Systems Subject to Airblast Loading.

R. AAMA/WDMA/CSA 101/I.S.2/A440 - Standard/Specification for Windows, Doors, and Unit Skylights; 2011

S. FM Standard 4431 - The Approval Standard for Skylights

T. UL 2108 - Low Voltage Lighting Systems

U. GSA-TS01-2003: Standard Test Method for Glazing and Window Systems Subject to Dynamic Overpressure Loadings

V. ICC-ES AC-16 - Acceptance Criteria for Plastic Skylights; 2008.

W. IBC Section 1710 - Load Test Procedure for Wind Load Testing on Rooftop Daylight Collecting System - Structural Performance Testing - Devised by ATI PE); 2012

X. IBC Section 2606.7.2 - Installation - Diffuser Fall Out Test (Devised by PE); 2012

Y. OSHA 29 CFR - 1910.23 (e)(8) (Guarding Requirements for Skylights); 1926 Subpart M (Fall Protection); 1926.501(b)(4)(i); 1926.501(i)(2); 1926.501(b)(4)(ii)

1.04 PERFORMANCE REQUIREMENTS

A. Air Infiltration Test:
   1. Air infiltration will not exceed 0.30 cfm/sf aperture with a pressure delta of 1.57 psf across the tube when tested in accordance with ASTM E 283.

B. Water Resistance Test:
   1. Passes water resistance; no uncontrolled water leakage with a pressure differential of 10.7 psf (512 Pa) or 15 percent of the design load (whichever is greater) and a water spray rate of 5 gallons/hour/sf for 24 minutes when tested in accordance with ASTM E 547 and ASTM E 331.

C. Uniform Load Test: All units tested with a safety factor of (3) for positive pressure and (2) for negative pressure, acting normal to plane of roof in accordance with ASTM E 330.
   1. No breakage, permanent damage to fasteners, hardware parts, or damage to make daylighting system inoperable or cause excessive permanent deflection of any section when tested at a Positive Load of 150 psf (7.18 kPa) or Negative Load of 70 psf (3.35 kPa).

D. Fire Testing:
   1. Fire Rated Roof Assemblies:
      a. When used with the Dome Edge Protection Band, all domes meet fire rating requirements as described in the International Building Code for Class A, B, and C roof assemblies.
   2. When used with the Dome Edge Protection Band, all domes meet fire rating requirements as described in the International Building Code.
   3. Self-Ignition Temperature - Greater than 650 degrees F per ASTM D-1929.
   4. Smoke Density: Rating no greater than 450 per ASTM Standard E 84 in way intended for use. Classification C.
   5. Rate of Burn and/or Extent: Maximum Burning Rate: 2.5 inches/min (62 mm/min) Classification CC-2 per ASTM D 635.
   6. Rate of Burn and/or Extent: Maximum Burn Extent: 1 inch (25 mm) Classification CC-1 per ASTM D 635.

E. Fall Protection Performance:

1. Passes fall protection test: No penetration of dome or curb cap when subject to 400 lb (160 Kg)/42 inch (1066 mm) impact drop test when tested in accordance with OSHA 29 CFR 1926.506(c) Safety Net Systems.
2. Passes fall protection test: California State OSHA Fall Protection Code of Regulations, Title 8, Section 3212 (e)(1) Skylight Screens.

1.05 SUBMITTALS

A. Submit under provisions of Section 01 30 00.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Data sheets showing roof dome assembly, flashing base, reflective tubes, diffuser assembly, and accessories.
4. Installation requirements.

C. Shop Drawings. Submit shop drawings showing layout, profiles and product components, including rough opening and framing dimensions, anchorage, roof flashings and accessories.

D. Verification Samples: As requested by Architect.

E. Test Reports: Independent testing agency or evaluation service reports verifying compliance with specified performance requirements.

F. LEED Submittals: Provide documentation of how the requirements of Credit will be met:
1. List of Daylight Credits available for the products specified.
2. Data on Energy Optimization Performance Credits for the products specified.
3. Data on Perimeter and Non-Perimeter Controllability of Systems for use of Daylight Dimmer option with the products specified.
4. Data on potential Innovation in Design Credits which may be available for the innovative use of the products specified.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in manufacturer's original containers, dry, undamaged, seals and labels intact.

B. Store products in manufacturer's unopened packaging until ready for installation.

1.07 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.08 WARRANTY

A. Daylighting Device: Manufacturer's standard warranty for 10 years.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Solatube International, Inc.; 2210 Oak Ridge Way, Vista, CA 92081. Tel. Toll Free: 888-765-2882. Tel: (760) 477-1120. Fax: (760) 597-4488. Email: commsales@solatube.com. Web: www.solatube.com

B. Velux America, Inc; Commercial Sun Tunnel Skylights: www.veluxusa.com/#sle.

C. Requests for substitutions will be considered in accordance with provisions of Division 1.

2.02 TUBULAR DAYLIGHTING DEVICES

A. Tubular Daylighting Devices General: Transparent roof-mounted skylight dome and self-flashing curb, reflective tube, and ceiling level diffuser assembly, transferring sunlight to interior spaces; complying with ICC AC-16.

B. SolaMaster Series: Solatube Model 750 DS, 21 inch (530 mm) Daylighting System:
   1. Model:Solatube Model 750 DS-C Closed (Penetrating) Ceiling. AAMA Type TDDCC.
      a. Solatube Model 750 DS-C Closed (Penetrating) Ceiling. AAMA Type TDDCC.
   2. Capture Zone:
      a. Roof Dome Assembly: Transparent, UV and impact resistant dome with flashing base supporting dome and top of tube.
         1) Outer Dome Glazing: Type DA, 0.125 inch (3.2 mm) minimum thickness injection molded acrylic classified as CC2 material; UV inhibiting (100 percent UV C, 100 percent UV B and 98.5 percent UV A), impact modified acrylic blend.
            (a) Raybender 3000: Variable prism optic molded into outer dome to capture low angle sunlight and limit high angle sunlight.

2.03 INNER ROOF DOME DUAL GLAZING

A. Inner Dome Glazing: Type DAI, 0.115 inch (3 mm) minimum thickness acrylic classified as CC2 material.

2.04 ACCESSORIES

A. Fasteners: Same material as metals being fastened, non-magnetic steel, non-corrosive metal of type recommended by manufacturer, or injection molded nylon.

B. Suspension Wire: Steel, annealed, galvanized finish, size and type for application and ceiling system requirement.

C. Sealant: Polyurethane or copolymer based elastomeric sealant as provided or recommended by manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. Examine openings, substrates, structural support, anchorage, and conditions for compliance with requirements for installation tolerances and other conditions.

C. If substrate and rough opening preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Coordinate requirements for power supply, conduit and wiring.

C. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's printed instructions.

B. Coordinate installation with substrates, air and vapor retarders, roof insulation, roofing membrane, and flashing to ensure that each element of the Work performs properly and that finished installation is weather tight.
   1. Install flashing to produce weatherproof seal with curb and overlap with roofing system termination at top of curb.
   2. Provide thermal isolation when components penetrate or disrupt building insulation. Pack fibrous insulation in rough opening to maintain continuity of thermal barriers.
   3. Coordinate attachment and seal of perimeter air and vapor barrier material.

C. Where metal surfaces of tubular unit skylights will contact incompatible metal or corrosive substrates, including preservative-treated wood, provide permanent separation as recommended by manufacturer

D. Align device free of warp or twist, maintain dimensional tolerances.

E. After installation of first unit, field test to determine adequacy of installation. Conduct water test in presence of Owner, Architect, or Contractor, or their designated representative. Correct if needed before proceeding with installation of subsequent units.

F. Inspect installation to verify secure and proper mounting. Test each fixture to verify operation, control functions, and performance. Correct deficiencies.

3.04 CLEANING

A. Clean exposed surfaces according to manufacturer's written instructions. Touch up damaged metal coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

3.05 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

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SECTION 08 70 00
DOOR HARDWARE SCHEDULE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preliminary schedule of door hardware sets for swinging, sliding, folding, and other door types as indicated on drawings.

1.02 RELATED REQUIREMENTS

A. Section 08 71 00 - Door Hardware: Requirements to comply with in coordination with this section.

1.03 REFERENCE STANDARDS

A. BHMA A156.18 - American National Standard for Materials and Finishes; 2012.

B. DHI (H&S) - Sequence and Format for the Hardware Schedule; 1996.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Only manufacturers listed in Door Hardware Schedule or Section 08 71 00 are considered acceptable, unless noted otherwise.

B. Obtain each type of door hardware as indicated from a single manufacturer and single supplier.

C. Manufacturer's Abbreviations: Coordinate with manufacturers listed in Section 08 71 00.
   1. AR - Adams Rite.
   2. CR - Corbin Russwin.
   3. CRL - C. R. Laurence.
   4. DMA - Dorma.
   5. HGR - Hager.
   6. HIA - Hiawatha.
   7. IVE - Ives.
   8. LCN - LCN.
   9. McK - McKinney.
   10. PEM - Pemko.
   11. RIX - Rixson.
   12. ROC - Rockwood.
   13. SA - Sargent.
   14. SCH - Schlage.
   15. SDC - Stanley Door Closers.
   16. SH - Stanley Hinges.
   17. STH - Stanley Commercial Hardware.
   18. TR - Trimco.
   19. VD - Von Duprin.

2.02 DESCRIPTION

A. Door hardware sets provided represent the design intent, they are only a guideline and should not be considered a detailed or complete hardware schedule.
   1. Provide door hardware item(s) as required for similar purposes, even when item is not listed for a door in Door Hardware Schedule.

2. Door hardware supplier is responsible for providing proper size and hand of door for products required in accordance with Door Hardware Schedule and as indicated on drawings.
3. Quantities listed are for each Pair (PR) of doors, or for each Single (SGL) door, as indicated in hardware sets.

2.03 FINISHES

A. Finishes: Complying with BHMA A156.18.

PART 3 EXECUTION

301 DOOR HARDWARE SCHEDULE

A. Guide: Door hardware items have been placed in sets which are intended to be a guide of design, grade, quality, function, operation, performance, exposure, and like characteristics of door hardware, and may not be complete. Provide door hardware required to make each set complete and operational.

B. Hardware schedule does not reflect handing, backset, method of fastening and like characteristics of door hardware and door operation.

C. Review door hardware sets with door types, frames, sizes and details on drawings. Verify suitability and adaptability of items specified in relation to details and surrounding conditions.

3.01 HARDWARE SCHEDULE

Set #1 Classrooms – Learning Labs Out Swing to wall at 90 degrees

Door Numbers: E101, E102, E104, E106, E112, E113, E114, E115, E116, E117, E118, E119, E146, E151, E201, E202, E203, E204, E205, E206, E208, E210A, E210B, E211, E212, E213, E214, E215, E216, E217, E218, E220, E225, E239, F101, F102, F103, F104, F105, F106, F107, F108, F201, F202, F203, F204, F205, F206, F207, F208
Each opening to receive:

Qty.	Type	Description	Finish	
3 ea.	Hinges	BB1279 4.5” x 4.5” NRP	US26D	HAG
1 ea.	Classroom Intruder Lock	L9071R 06A	US26D	SCH
2 ea.	Core	Match Existing System	US26D	SCH
1 ea.	Kick Plate	190S 10” x 2” LDW	US32D	HAG
1 ea.	Floor Stop/Holder	327W	US26D	HAG
1 ea.	Gasket	726 head and jambs	Char	HAG

Set #1A Classrooms – Learning Labs Out Swing with OH stop

Door Numbers: E103, E105
Each opening to receive:

Qty.	Type	Description	Finish	
3 ea.	Hinges	BB1279 4.5” x 4.5” NRP	US26D	HAG
1 ea.	Classroom Intruder Lock	L9071R 06A	US26D	SCH
2 ea.	Core	Match Existing System	US26D	SCH
1 ea.	O.H. Holder	7017 SRF	US26D	HAG
1 ea.	Kick Plate	190S 10” x 2” LDW	US32D	HAG
1 ea.	Gasket	726 head and jambs	Char	HAG

Set #2 Learning Lab, Offices, In-Swing

Door Numbers: C105A, C105B, C106A, C106B, D109, D111, D113A, D113B, D114, D115, D116, D117, D123, D138, D150, D160, D161, E109A, E109B, E110, E111, E134, E140, E143, E148, E207, E209, E223, E221, E222, E224, E229, E240, E242
Each opening to receive:

Qty.	Type	Description	Finish	
3 ea.	Hinges	BB1279 4.5” x 4.5” NRP	US26D	HAG
1 ea.	Classroom Intruder Lock	L9071R 06A	US26D	SCH
2 ea.	Core	Match Existing System	US26D	SCH
1 ea.	Kick Plate	190S 10” x 2” LDW	US32D	HAG
1 ea.	Wall Stop	236W	US32D	HAG
1 ea.	Gasket	726 head and jambs	Char	HAG

Set #3 Offices, In-Swing & alcove out-swing with closer

Door Numbers: C107A, D103A, D103.1, D103B, D104, D119B, D120A, D120B, D122, D127, D132B
Each opening to receive:

Qty.	Type	Description	Finish	
3 ea.	Hinges	BB1279 4.5” x 4.5” NRP	US26D	HAG
1 ea.	Classroom Intruder Lock	L9071R 06A	US26D	SCH
2 ea.	Core	Match Existing System	US26D	SCH
1 ea.	Closer	4000	ALM	LCN
1 ea.	Kick Plate	190S 10” x 2” LDW	US32D	HAG
1 ea.	Wall Stop	236W	US32D	HAG
1 ea.	Gasket	726 head and jambs	Char	HAG

Set #3A Band Room

Door Numbers: C112A
Each opening to receive:

Qty.	Type	Description	Finish	
6 ea.	Hinges	BB1279 4.5” x 4.5” NRP	US26D	HAG
1 ea.	Surface Bolt	275D	US26D	HAG
1 ea.	Classroom Intruder Lock	L9071R 06A	US26D	SCH
2 ea.	Core	Match Existing System	US26D	SCH
1 ea.	Closer	4111 CUSH (Active leaf)	ALM	LCN
1 ea.	O.H. Holder	7016 SRF (Inactive leaf)	US26D	HAG
2 ea.	Kick Plate	190S 10” x 1” LDW	US32D	HAG
1 ea.	Threshold	412S door opening width	MIL	HAG
1 ea.	Sound Gasket	726 head and jambs	Char	HAG
1 ea.	Sound Gasket	722 Meeting stiles at astragal	Char	HAG
2 ea.	Concealed Auto. Door Bottoms	730S N door width	MIL	HAG
1 ea.	Astragal	835S door height	MIL	HAG

Set #3B Choral Room, Music Room

Door Numbers: C110, C111A
Each opening to receive:

Qty.	Type	Description	Finish	
3 ea.	Hinges	BB1279 4.5” x 4.5” NRP	US26D	HAG
1 ea.	Classroom Intruder Lock	L9071R 06A	US26D	SCH
2 ea.	Core	Match Existing System	US26D	SCH
1 ea.	Closer	4000	ALM	LCN
1 ea.	Kick Plate	190S 10” x 2” LDW	US32D	HAG
1 ea.	Wall Stop	236W	US32D	HAG
1 ea.	Threshold	412S door opening width	MIL	HAG
1 ea.	Sound Gasket	726 head and jambs	Char	HAG
1 ea.	Concealed Auto. Door Bottom	730S N door width	MIL	HAG

Set #4 Classroom, Nurses, Faculty & Cafeteria Sgl. Use Toilets

Door Numbers: D125, D126, D128, D129, D131.1, D136, E102.1, F111A, F111B, F211A, F211B
Each opening to receive:

Qty.	Type	Description	Finish	
3 ea.	Hinges	BB1279 4.5” x 4.5” NRP	US26D	HAG
1 ea.	Privacy Lock, with indicator	L9496 06A	US26D	SCH
1 ea.	Closer	4000	ALM	LCN
1 ea.	Kick Plate	190S 10” x 2” LDW	US32D	HAG
1 ea.	Wall Stop	236W	US32D	HAG
3 ea.	Silencers	307D	Gray	HAG

Set #4A Classroom, Nurses, Faculty & Cafeteria Sgl. Use Toilets

Door Numbers: D105, D106
Each opening to receive:

Qty.	Type	Description	Finish	
3 ea.	Hinges	BB1279 4.5” x 4.5” NRP	US26D	HAG
1 ea.	Privacy Lock, with indicator	L9496 06A	US26D	SCH
1 ea.	Kick Plate	190S 10” x 2” LDW	US32D	HAG
1 ea.	Wall Stop	236W	US32D	HAG
3 ea.	Silencers	307D	Gray	HAG

Set #5 Sensory Room (BSAP)

Door Numbers: F112A, F112B, F210A, F210B
Each opening to receive:

Qty.	Type	Description	Finish	
3 ea.	Hinges	BB1279 4.5” x 4.5”	US26D	HAG
1 ea.	Passage Latch	L9010 06A	US26D	SCH
1 ea.	Kick Plate	190S 10” x 2” LDW	US32D	HAG
1 ea.	Floor Stop	242F	US26D	HAG
3 ea.	Silencers	307D	Gray	HAG

Set #6 Fire Rated Dry Storage Kitchen

Door Numbers: D133
Each opening to receive:

Qty.	Type	Description	Finish	
3 ea.	Hinges	BB1279 4.5” x 4.5”	US26D	HAG
1 ea.	Passage Latch	L9010 06A	US26D	SCH
1 ea.	Closer	4000	ALM	LCN
1 ea.	Kick Plate	190S 10” x 2” LDW	US32D	HAG
1 ea.	Wall Stop	236W	US32D	HAG
3 ea.	Silencers	307D	Gray	HAG

Set #7 Storage, Interior Roof Access – Out Swing

Door Numbers: C111.1, C112.1, D119.1, D130, D131.2, E130.1, E132, E234.1, E245, F110, F212
Each opening to receive:

Qty.	Type	Description	Finish	
3 ea.	Hinges	BB1279 4.5” x 4.5” NRP	US26D	HAG
1 ea.	Storeroom Lock	L9080R 06A	US26D	HAG
1 ea.	Core	Match Existing System	US26D	-
1 ea.	Kick Plate	190S 10” x 2” LDW	US32D	HAG
1 ea.	O.H. Holder	7016 SRF	US26D	HAG
1 ea.	Gasket	726 head and jambs	Char	HAG

Set #8 Storage, IDF – In Swing

Door Numbers: D108, D110, D112, D120.1, D124, D137, D162, E144, E147, E150, E227, E241
Each opening to receive:

Qty.	Type	Description	Finish	
3 ea.	Hinges	BB1279 4.5” x 4.5” NRP	US26D	HAG
1 ea.	Storeroom Lock	L9080R 06A	US26D	HAG
1 ea.	Core	Match Existing System	US26D	-
1 ea.	Kick Plate	190S 10” x 2” LDW	US32D	HAG
1 ea.	Wall Stop	236W	US32D	HAG
1 ea.	Gasket	726 head and jambs	Char	HAG

Set #9 Exterior Storage

Door Numbers: D154A, D154B
Each opening to receive:

Qty.	Type	Description	Finish	
3 ea.	Hinges	BB1191 4.5” x 4.5” NRP	US32D	HAG
1 ea.	Storeroom Lock	L9080R 06A	US26D	HAG
1 ea.	Core	Match Existing System	US26D	-
1 ea.	Kick Plate	190S 10” x 2” LDW	US32D	HAG
1 ea.	O.H. Holder	7016 SRF	US26D	HAG
1 ea.	Threshold	412S door width	MIL	HAG
1 ea.	Gasket	726 head and jambs	Char	HAG
1 ea.	Sweep	770S V door width	MIL	HAG

Set #10 Exterior Class access

Door Numbers: C103B, C107B, C111B, C112B
Each opening to receive:

Qty.	Type	Description	Finish	
3 ea.	Hinges	BB1191 4.5” x 4.5” NRP	US32D	HAG
1 ea.	Classroom Intruder Lock	L9071R 06A	US26D	SCH
2 ea.	Core	Match Existing System	US26D	SCH
1 ea.	Closer	4111CUSH	ALM	LCN
1 ea.	Kick Plate	190S 10” x 2” LDW	US32D	HAG
1 ea.	Threshold	412S door width	MIL	HAG
1 ea.	Gasket	726 head and jambs	Char	HAG
1 ea.	Sweep	770S V door width	MIL	HAG
1 ea.	Drip Cap	810S door width + 4”	MIL	HAG

Set #11 Exterior Utility - Pair

Door Numbers: C101B
Each opening to receive:

Qty.	Type	Description	Finish	
6 ea.	Hinges	BB1191 4.5” x 4.5” NRP	US32D	HAG
2 ea.	Flush Bolt	282D	US26D	HAG
1 ea.	Storeroom Lock	L9080R 06A	US26D	HAG
1 ea.	Core	Match Existing System	US26D	-
2 ea.	Kick Plate	190S 10” x 1” LDW	US32D	HAG
1 ea.	O.H. Holder	7016 SRF (2’0” inactive leaf)	US26D	HAG
1 ea.	Closer	4111HCUSH (3’0” active leaf)	ALM	LCN
1 ea.	Gasket	726 head and jambs	Char	HAG

Set #11A Exterior Utility – Pair with Card Reader

Door Numbers: D132A
Each opening to receive:

Qty.	Type	Description	Finish	
1 ea.	Electrified Hinge	BB1191 4.5” x 4.5” ETW	US32D	HAG
5 ea.	Hinges	BB1191 4.5” x 4.5” NRP	US32D	HAG
2 ea.	Flush Bolt	282D	US26D	HAG
1 ea.	Electric Storeroom Lock	L9080REU 06A	US32D	SCH
1 ea.	Core	Match Existing System	US26D	SCH
2 ea.	Kick Plate	190S 10” x 1” LDW	US32D	HAG
2 ea.	Closer	4111 HCUSH	ALM	LCN
1 ea.	Threshold	412S door opening width	MIL	HAG
1 ea.	Gasket	726 head and jambs	Char	HAG
2 ea.	Sweeps	770S V door width	MIL	HAG
1 ea.	Power Supply	2903	-	HAG

120VAC power, conduit and wiring by Division 26.
Card Reader by Division 28.
Description of Operation: Door normally closed and locked. Key retracts latch. Removing key leaves door locked. Access upon proper credential validation at the card reader. In the event of a power failure the lock-set remains locked (fail secure). Free egress at all times

Set #12 Interior Utility - Pair

Door Numbers: D163
Each opening to receive:

Qty.	Type	Description	Finish	
6 ea.	Hinges	BB1191 4.5” x 4.5” NRP	US32D	HAG
2 ea.	Flush Bolt	282D	US26D	HAG
1 ea.	Storeroom Lock	L9080R 06A	US26D	HAG
1 ea.	Core	Match Existing System	US26D	-
1 ea.	O.H. Holder	7016 SRF (2’0” inactive leaf)	US26D	HAG
1 ea.	Closer	4111 HCUSH (3’0” active leaf)	ALM	LCN
2 ea.	Kick Plate	190S 10” x 1” LDW	US32D	HAG
1 ea.	Threshold	412S door width	MIL	HAG
1 ea.	Gasket	726 head and jambs	Char	HAG
2 ea.	Sweep	770S V door opening width	MIL	HAG
1 ea.	Drip Cap	810S door opening width + 4”	MIL	HAG

Set #12A Interior Utility - Pair

Door Numbers: D119A
Each opening to receive:

Qty.	Type	Description	Finish	
6 ea.	Hinges	BB1191 4.5” x 4.5” NRP	US32D	HAG
2 ea.	Flush Bolt	282D	US26D	HAG
1 ea.	Classroom Intruder Lock	L9071R 06A	US26D	SCH
2 ea.	Core	Match Existing System	US26D	SCH
1 ea.	O.H. Holder	7016 SRF (2’0” inactive leaf)	US26D	HAG
1 ea.	Closer	4111 HCUSH (3’0” active leaf)	ALM	LCN
2 ea.	Kick Plate	190S 10” x 1” LDW	US32D	HAG
1 ea.	Threshold	412S door width	MIL	HAG
1 ea.	Gasket	726 head and jambs	Char	HAG
2 ea.	Sweep	770S V door opening width	MIL	HAG
1 ea.	Drip Cap	810S door opening width + 4”	MIL	HAG

Set #13 Interior Stage – Pair – Fire rated

Door Numbers: C119A
Each opening to receive:

Qty.	Type	Description	Finish	
6 ea.	Hinges	BB1191 4.5” x 4.5” NRP	US32D	HAG
1 set	Automatic Flush Bolt	292D	US26D	HAG
1 ea.	Classroom Intruder Lock	L9071R 06A	US26D	SCH
2 ea.	Core	Match Existing System	US26D	SCH
2 ea.	Closer	4111 HCUSH (3’0” active leaf)	ALM	LCN
1 ea.	Coordinator	297D	USP	HAG
2 ea.	Mtg Brackets	297M/N	USP	HAG
2 ea.	Kick Plate	190S 10” x 1” LDW	US32D	HAG
2 ea.	Magnetic Holders	380 Series wall mount	ALM	HAG
1 ea.	Threshold	412S door width	MIL	HAG
1 ea.	Gasket	726 head and jambs	Char	HAG
2 ea.	Sweep	770S V door opening width	MIL	HAG
1 ea.	Drip Cap	810S door opening width + 4”	MIL	HAG

Description of Operation: Doors normally closed and latched. Active leaf leaver trim locked or unlocked with key. Magnetic holders provided to allow easier access to the stage area. Connect magnetic holders to the fire alarm system so they shunt (de-energize) in the event of a fire so doors release to mechanically latch for fire barrier.

Set #14 Interior Auditorium Main entrance – Unequal Pair

Door Numbers: C118B, C118C, C118D, C118E, C118F
Each opening to receive:

Qty.	Type	Description	Finish	
6 ea.	Hinges	BB1279 4.5” x 4.5” NRP	US26D	HAG
1 set	Automatic Flush Bolt	296W (2’0” inactive leaf)	US26D	HAG
1 ea.	Mortise Panic Device	9875-L-06 (3’0” active leaf)	US26D	HAG
1 ea.	Mortise Cylinder & Core	Match Existing System	US26D	-
2 ea.	Closer	4111 HCUSH	ALM	HAG
1 ea.	Coordinator	297D	USP	HAG
2 ea.	Mtg Brackets	297M/N	USP	HAG
2 ea.	Kick Plate	190S 10” x 1” LDW	US32D	HAG
1 ea.	Threshold	412S door width	MIL	HAG
1 ea.	Gasket	726 head and jambs	Char	HAG

Set #15 Interior Auditorium Access – Unequal Pair – Fire Rated

Door Numbers: C118A, C119D
Each opening to receive:

Qty.	Type	Description	Finish	
6 ea.	Hinges	BB1279 4.5” x 4.5” NRP	US26D	HAG
1 set	Automatic Flush Bolt	292D (2’0” inactive leaf)	US26D	HAG
1 ea.	Mortise Fire Exit Device	9875F-L (3’0” active leaf)	US26D	HAG
1 ea.	Mortise Cylinder & Core	Match Existing System	US26D	-
1 ea.	Coordinator	297D	USP	HAG
2 ea.	Mtg Brackets	297M/N	USP	HAG
2 ea.	Closer	4111 CUSH	ALM	LCN
2 ea.	Kick Plate	190S 10” x 1” LDW	US32D	HAG
2 ea.	Magnetic Holders	380 Series wall mount	ALM	HAG
1 ea.	Threshold	412S door width	MIL	HAG
1 ea.	Gasket	726 head and jambs	Char	HAG

Description of Operation: Doors normally closed and latched. Active leaf leaver trim locked or unlocked with key. Magnetic holders provided to allow easier mass access or egress for venue. Connect magnetic holders to the fire alarm system so they shunt (de-energize) in the event of a fire so doors release to mechanically latch for fire barrier.

Set #15A Art Room Access – Unequal Pair – Fire Rated

Door Numbers: C101A
Each opening to receive:

Qty.	Type	Description	Finish	
6 ea.	Hinges	BB1279 4.5” x 4.5” NRP	US26D	HAG
1 set	Automatic Flush Bolt	292D (2’0” inactive leaf)	US26D	HAG
1 ea.	Classroom Intruder Lock	L9071R 06A	US26D	SCH
2 ea.	Core	Match Existing System	US26D	SCH
1 ea.	Coordinator	297D	USP	HAG
2 ea.	Mtg Brackets	297M/N	USP	HAG
2 ea.	Closer	4111 CUSH	ALM	HAG
2 ea.	Kick Plate	190S 10” x 1” LDW	US32D	HAG
2 ea.	Magnetic Holders	380 Series wall mount	ALM	HAG
1 ea.	Threshold	412S door width	MIL	HAG
1 ea.	Gasket	726 head and jambs	Char	HAG

Description of Operation: Doors normally closed and latched. Lock-set locked or unlocked with key. Magnetic holders provided to allow easier access or egress with art work. Connect magnetic holders to the fire alarm system so they shunt (de-energize) in the event of a fire so doors release to mechanically latch for fire barrier.

Set #16 Stairs – Fire Rated

Door Numbers: ST2.1A, ST2.2, ST3.1A, ST3.2
Each opening to receive:

Qty.	Type	Description	Finish

All hardware by Total Door Systems integrated steel doors for 90 degree hold open

Set #17 Stairs & Cross Corridor - Pair – Fire Rated

Door Numbers: C113A, C117A, D140, ST1.2, ST4.1A, ST4.2
Each opening to receive:

All hardware by Total Door Systems integrated steel doors for 90 degree hold open

Set #17A Stairs & Cross Corridor - Pair – Fire Rated

Door Numbers: ST1.1A
Each opening to receive:

All hardware by Total Door Systems integrated steel doors for 180 degree hold open

Set #18 Lobby from Stairs - Pair – Fire Rated

Door Numbers: ST1.1B
Each opening to receive:

Qty.	Type	Description	Finish	
2 ea.	Hinges	BB1279 5” x 4.5” ETW	US26D	HAG
4 ea.	Hinges	BB1279 5” x 4.5” NRP	US26D	HAG
2 ea.	MLR Fire Exit Device SVR	9827-F-LBR-QEL-LNL-06 w/fire bolt	US26D	VD
1 ea.	Rim Cylinder & Core	Match Existing System	US26D	-
2 ea.	Closer	4000	ALM	LCN
2 ea.	Kick Plate	190S 10” x 1” LDW	US32D	HAG
2 ea.	Wall Stop	236W	US32D	HAG
1 ea.	Gasket	726 head and jambs	Char	HAG
1 ea.	Power Supply	2903	-	HAG
1 ea.	Key Switch	29KS 2LED	US32D	HAG
1 ea.	Mortise Cylinder & Core	Match Existing System (for key switch)	US26D	-

Description of Operation: Key retracts latch. Removing the key leaves the door locked. Key switch can be turned on to electrically dog the fire exit devices for push and pull operation as required. MLR devices must be connected to the fire alarm to shunt (de-energize) in the event of a fire alarm.

Set #19 Stairs – Pair Alum Exterior Non- Rated

Door # C106E, C106F, C106G, C117B, C117C, C117D, D101C, D121B, ST4.1B
Each opening to receive:

Qty	Type	Description	Finish	
2 ea.	Continuous Hinge	780-224 HD	Clear	HAG
2 ea.	Rim Exit Device	CD35A-EO	US26D	VD
2 ea.	Mortise Cylinder & Core	Match Existing System (for CD)	US26D	SCH
2 ea.	Off-set Pulls	11J	US32D	HAG
1 ea.	Keyed Rem. Mullion	4900T	USP	HAG
1 ea.	Rim Cylinder & Core	Match Existing System (for KRM)	US26D	-
2 ea.	Closer w/hold open	4111 HCUSH	ALUM	LCN
2 ea.	Drop Plate	5110 (as required)	ALUM	HAG
2 ea.	Blade Stop Spacer	5113 (as required)	ALUM	HAG
1 ea.	Threshold	412S	MIL	HAG

Weather-strip and sweeps by door manufacturer.

Set #19A Stairs – Pair Alum Exterior Non- Rated with Card Reader

Door # D101B, D121A, D155, E120, ST2.1B, ST3.1B, ST4.1C
Each opening to receive:

Qty	Type	Description	Finish	
2 ea.	Continuous Hinge	780-224 HD	Clear	HAG
1 ea.	Rim Exit Device	CD35A-EO (Inactive Leaf)	US26D	VD
1 ea.	MLR Rim Exit Device	4601 MLR Night Latch (NL)	US32D	HAG
1 ea.	Rim Cylinder & Core	Match Existing System (for NL)	US26D	SCH
1 ea.	Mortise Cylinder & Core	Match Existing System (for CD)	US26D	SCH
2 ea.	Off-set Pulls	11J	US32D	HAG
1 ea.	Keyed Rem. Mullion	4900T	USP	HAG
1 ea.	Rim Cylinder & Core	Match Existing System (for KRM)	US26D	SCH
2 ea.	Closer w/hold open	4111 HCUSH	ALUM	LCN
2 ea.	Drop Plate	(as required)	ALUM	LCN
2 ea.	Blade Stop Spacer	(as required)	ALUM	LCN
1 ea.	Threshold	412S	MIL	HAG
1 ea.	Power Supply	2904	- _	HAG

Weather-strip and sweeps by door manufacturer.
120VAC power, conduit and wiring by Division 26.
Card Reader by Division 28.
Description of Operation: Door normally closed and locked. Key retracts latch. Removing key leaves door locked. Access upon proper credential validation at the card reader. In the event of a power failure the device remains locked (fail secure). Free egress at all times

Set #20 Stairs – Pair Alum Vestibule Non- Rated

Door # D131D
Each opening to receive:

Qty	Type	Description	Finish	
2 ea.	Cont. Hinge	780-224HD	Clear	HAG
2 ea.	Push/Pull Bars	157V Center push bar in door stiles	US32D	HAG
2 ea.	Closer w/hold open	4111 CUSH	ALUM	LCN
2 ea.	Drop Plate	5110 (as required)	ALUM	HAG
2 ea.	Blade Stop Spacer	5113 (as required)	ALUM	HAG
1 ea.	Threshold	412S door opening width	MIL	HAG

Weather-strip and sweeps by door manufacturer.

Set #21 Stairs – SGL. Alum Exterior Non- Rated

Door # D131C
Each opening to receive:

Qty	Type	Description	Finish	
1 ea.	Continuous Hinge	780-224 HD	Clear	HAG
1 ea.	Rim Exit Device	35A-NL-OP	US32D	VD
1 ea.	Rim Cylinder & Core	Match Existing System (for NL)	US26D	SCH
1 ea.	Off-set Pull	11J	US32D	HAG
1 ea.	Closer	4111 CUSH	ALUM	LCN
1 ea.	Drop Plate	(as required)	ALUM	LCN
1 ea.	Blade Stop Spacer	(as required)	ALUM	LCN
1 ea.	Threshold	412S	MIL	HAG

Weather-strip and sweeps by door manufacturer.

Set #22 Media Center & Cafeteria - Interior Pair Alum Non- Rated

Door # D101A, D131A, D131B, E108A
Each opening to receive:

Qty	Type	Description	Finish	
2 ea.	Continuous Hinge	780-224 HD	Clear	HAG
2 ea.	Rim Exit Device	CD35A-EO	US32D	VD
2 ea.	Mortise Cylinder & Core	Match Existing System (for CD)	US26D	SCH
2 ea.	Off-set Pulls	11J	US32D	HAG
1 ea.	Keyed Rem. Mullion	4900T	USP	HAG
1 ea.	Rim Cylinder	Match Existing System (for KRM)	US26D	SCH
2 ea.	Closer	4111 CUSH	ALUM	LCN
2 ea.	Closer	4111 HCUSH (E106A)	ALUM	LCN
2 ea.	Drop Plate	(as required)	ALUM	LCN
2 ea.	Blade Stop Spacer	(as required)	ALUM	LCN
1 ea.	Threshold	412S	MIL	HAG

Weather-strip and sweeps by door manufacturer.

Set #23 Multi-use Toilets

Door Numbers: D152, D153, E124, E125
Each opening to receive:

Qty.	Type	Description	Finish	
3 ea.	Hinges	BB1279 4.5” x 4.5”	US26D	HAG
1 ea.	Aux Mortise Classroom Dead-bolt	L463R	US26D	SCH
1 ea.	Core	Match Existing System	US26D	SCH
1 ea.	Push Plate	30S 4” x 16”	US32D	HAG
1 ea.	Pull Plate	33E 4” x 16”	US32D	HAG
1 ea.	Closer	4000	ALM	LCN
1 ea.	Kick Plate	190S 10” x 2” LDW	US32D	HAG
1 ea.	Wall Stop	236W	US32D	HAG
3 ea.	Silencers	307D	Gray	HAG

Set #24 Sgl Media Room Exit

Door Numbers: E108B
Each opening to receive:

Qty.	Type	Description	Finish	
3 ea.	Hinges	BB1279 4.5” x 4.5”	US26D	HAG
1 ea.	Panic Device	CD98L-NL-06	US26D	VD
1 ea.	Rim Cylinder & Core	Match Existing System (NL)	US26D	SCH
1 ea.	Mortise Cylinder & Core	Match Existing System (CD)	US26D	SCH
1 ea.	Closer	4000	ALM	LCN
1 ea.	Kick Plate	190S 10” x 2” LDW	US32D	HAG
1 ea.	Wall Stop	236W	US32D	HAG
1 ea.	Gasket	726 head and jambs	Char	HAG

Set #25 Cafeteria Sliding Barn Door Bi-Parting Pair

Door Numbers: D132C
Each opening to receive:

Qty.	Type	Description	Finish	
1 ea.	Track & Hardware	2620 Bi-Parting Sliding Dr. Hdw. Kit	P.C.	RW
2 ea.	Latching Pull	LLPA60BS less exterior side	US32D	CRL
2 ea.	Flush Pull	15C	US32D	HAG
4 ea.	Dust Proof Strike	58DKBS	US32D	CRL

P.C. = Powder Coat finish for bard doors track and hardware

Set #26 Cafeteria Sliding Barn Door Sgl.

Door Numbers: D132D
Each opening to receive:

Qty.	Type	Description	Finish	
1 ea.	Track & Hardware			
1 ea.	Latching Pull	LLPA60BS less exterior side	US32D	CRL
1 ea.	Flush Pull	15C	US32D	HAG
2 ea.	Dust Proof Strike	58DKBS	US32D	CRL

Set #27 Closet Bi-pass

Door Numbers: D107
Each opening to receive:

Qty.	Type	Description	Finish	
1 ea.	Bi-Pass Track & Hardware	9673-60	ALM	HAG
2 ea.	Flush Pulls	2630	US26D	HAG

Set #28 Existing doors

Door Numbers: B101A, B101B, B101C, B101D, B101E, B102, B103, B104, B105, B106A, B106B. B107, B108A, B110, B112, C102, C103A, C104, C108, C109, C119B, C119C, C119.1, E101.1, E103.1, E104.1, E105.1, E106.1, E123.1, E231, E126, E128, E128.1, E233, E233.1, E236, E236.1, E238, E245.1
Each opening to receive:

Qty.	Type	Description	Finish

All existing hardware to remain. Repair or replace any hardware that does not function properly.

Set #29 Electrical Room Bid doors

Door Numbers: E107A, E107B, ST5.1
Each opening to receive:

Qty.	Type	Description	Finish

These doors addressed under previous project (Electrical Room Renovations)

Set #30 Pair – Exterior from Corridor

Door Numbers: C113B
Each opening to receive:

Qty.	Type	Description	Finish	
6 ea.	Hinges	BB1191 4.5” x 4.5” NRP	US32D	HAG
2 ea.	Rim Panic Device	CD98L-NL-06	US26D	VD
1 ea.	Rim Cylinder & Core	Match Existing System (for NL)	US26D	SCH
2 ea.	Mortise Cylinder & Core	Match Existing System (for CD)	US26D	SCH
1 ea.	Keyed Rem. Mullion	4900T	USP	HAG
1 ea.	Rim Cylinder & Core	Match Existing System (for KRM)	US26D	SCH
2 ea.	Closer	4111 CUSH	ALM	LCN
2 ea.	Kick Plate	190S 10” x 1” LDW	US32D	HAG
1 ea.	Threshold	412S door opening width	MIL	HAG
1 ea.	Gasket	726 head and jambs	Char	HAG
2 ea.	Sweeps	770S V door width	MIL	HAG
1 set	Astragal Weather-strip	872S 2x door height	Clear	HAG
1 ea.	Drip Cap	810S door opening width + 4”	Mil	HAG

Set #30A Pair – Exterior from Corridor

Door Numbers: C114
Each opening to receive:

Qty.	Type	Description	Finish	
6 ea.	Hinges	BB1191 4.5” x 4.5” NRP	US32D	HAG
2 ea.	Rim Panic Device	CD98L-NL-06	US26D	VD
1 ea.	Rim Cylinder & Core	Match Existing System (for NL)	US26D	SCH
2 ea.	Mortise Cylinder & Core	Match Existing System (for CD)	US26D	SCH
1 ea.	Keyed Rem. Mullion	4900T	USP	HAG
1 ea.	Rim Cylinder & Core	Match Existing System (for KRM)	US26D	SCH
2 ea.	Closer	4111 CUSH	ALM	LCN
2 ea.	Kick Plate	190S 10” x 1” LDW	US32D	HAG
1 ea.	Threshold	412S door opening width	MIL	HAG
1 ea.	Gasket	726 head and jambs	Char	HAG
2 ea.	Sweeps	770S V door width	MIL	HAG
1 set	Astragal Weather-strip	872S 2x door height	Clear	HAG

Set #31 Pair – Sectional O.H. Door

Door Numbers: C107C
Each opening to receive:

Qty.	Type	Description	Finish

All hardware by sectional O.H. Door manufacturer

Set #31A – NANAWALL

Door Numbers: E109A
Each opening to receive:

Qty.	Type	Description	Finish

All hardware by NANAWALL

Set #32 Office - Interior Sgl. Alum with card reader

Door # D102A
Each opening to receive:

Qty	Type	Description	Finish	
1 ea.	Electrified Continuous Hinge	780-224 HD RETW	Clear	HAG
1 ea.	Electrified Lock	L9080REU 06A	US26D	SCH
1 ea.	Core	Match Existing System	US26D	SCH
1 ea.	Closer	4111 CUSH	ALUM	LCN
1 ea.	Under Desk Push Switch	2-679-0708	White	HAG
1 ea.	Power Supply	2903	-	HAG

Weather-strip by door manufacturer.
120VAC power, conduit and wiring by Division 26.
Card Reader by Division 28.
Description of Operation: Door normally closed and locked. Key retracts latch. Removing key leaves door locked. Access upon proper credential validation at the card reader or by remote switch at desk. In the event of a power failure the lockset remains locked (fail secure). Free egress at all times.

Set #32A Office - Interior Sgl. Alum with card reader

Door # D102B
Each opening to receive:

Qty	Type	Description	Finish	
1 ea.	Electrified Continuous Hinge	780-224 HD RETW	Clear	HAG
1 ea.	Electrified Lock	L9080REU 06A	US26D	SCH
1 ea.	Core	Match Existing System	US26D	SCH
1 ea.	Closer	4000	ALUM	LCN
1 ea.	Wall Stop	236W	US32D	HAG
1 ea.	Under Desk Push Switch	2-679-0708	White	HAG
1 ea.	Power Supply	2903	-	HAG

Weather-strip by door manufacturer.
120VAC power, conduit and wiring by Division 26.
Description of Operation: Door normally closed and locked. Key retracts latch. Removing key leaves door locked. Access to corridor by remote switch at desk. In the event of a power failure the lockset remains locked (fail secure). Free egress at all times.

END OF SECTION

SECTION 08 71 00
DOOR HARDWARE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hardware for wood, aluminum, and hollow metal doors.

B. Hardware for fire-rated doors.

C. Electrically operated and controlled hardware.

D. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

E. Products supplied but not installed under this Section:
   1. Hardware for aluminum doors will be furnished under this Section, but installed under Division 08 Openings
   2. Hold open wall magnets.
   3. Electrified hardware will be furnished under this Section, but installed by the security contractor.

F. A. Section includes furnishing and installation of door hardware for doors specified in "Hardware Sets" and required by actual conditions. Including screws, bolts, expansion shields, electrified door hardware, and other devices for proper application of hardware.

G. Where items of hardware are not specified and are required for intended service, such omission, error or other discrepancy to be submitted to Architect fourteen calendar days prior to bid date for clarification by addendum.

1.02 RELATED REQUIREMENTS

A. Section 07 92 00 - Joint Sealants: Sealants for setting exterior door thresholds.

B. Section 08 11 13 - Hollow Metal Doors and Frames.

C. Section 08 11 16 - Aluminum Doors and Frames.

D. Section 08 14 16 - Flush Wood Doors.

E. Section 08 43 13 - Aluminum-Framed Storefronts: Door hardware, except as noted in section.

F. Related Divisions:
   1. Division 08 Openings
   2. Division 13 Special Construction
   3. Division 26 Electrical
   4. Division 28 Electronic Safety And Security

G.

1.03 REFERENCE STANDARDS

A. American National Standards Institute/Builders Hardware Manufacturers Association (ANSI):
   1. ANSI/BHMA A156.1 Butts & Hinges (2006)
   2. ANSI/BHMA A156.3 Exit Devices (2014)
   3. ANSI/BHMA A156.4 Door Controls - Closers (2008)
   4. ANSI/BHMA A156.6 Architectural Door Trim (2010)
   5. ANSI/BHMA A156.7 Template Hinge Dimensions (2009)

6. ANSI/BHMA A156.8 Door Controls - Overhead Stops and Holders (2010)
7. ANSI/BHMA A156.13 Mortise Locks & Latches (2005)
8. ANSI/BHMA A156.14 Sliding & Folding Door Hardware (2007)
9. ANSI/BHMA A156.16 Auxiliary Hardware (2008)
10. ANSI/BHMA A156.18 Materials & Finishes (2006)
11. ANSI/BHMA A156.21 Thresholds (2009)
12. ANSI/BHMA A156.22 Door Gasketing Systems (2012)
13. ANSI/BHMA A156.25 Electrified Locks (2007)
14. ANSI/BHMA A156.26 Continuous Hinges (2006)
15. ANSI/BHMA A156.28 Keying Systems (2007)
16. ANSI/BHMA A156.32 Integrated Door Assemblies (2008)
17. ANSI/BHMA A156.36 Auxiliary Locks (2010)
18. ANSI/BHMA A156.115 Hardware Preparation in Steel Doors and Steel Frames (2014)
19. ANSI/BHMA A156.115W Hardware Preparation in Wood Doors with Wood or Steel Frames (2006)

B. International Code Council/American National Standards Institute (ICC/ANSI)/ADA:
1. ICC/ANSI A117.1 Standards for Accessible and Usable Buildings and Facilities 2009
2. Americans with Disabilities Act Accessibility Guidelines (ADAAG).

C. Underwriters Laboratories, Inc. (UL):
1. UL 10C Positive Pressure Fire Test of Door Assemblies
2. UL 1784 Air Leakage Test of Door Assemblies
3. UL/ULC Listed

D. Door and Hardware Institute (DHI):
1. DHI Publication - Keying Systems and Nomenclature (1989)
2. DHI Publication - Abbreviations and Symbols
3. DHI Publication - Installation Guide for Doors and Hardware
4. DHI Publication - Sequence and Format of Hardware Schedule (1996)

E. National Fire Protection Agency (NFPA)
1. NFPA 70 National Electrical Code 2014
2. NFPA 80 Standard for Fire Doors and Other Opening Protective's 2013
3. NFPA 101 Life Safety Code 2015
4. NFPA 105 Standard for the Installation of Smoke Door Assemblies 2013

F. Building Codes
1. IBC International Building Code 2015
2. Local Building Code

G. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

1.04 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project, and includes construction details, material descriptions, finishes, and dimensions and profiles of individual components.

C. Shop Drawings:

1. Organize hardware schedule organized in vertical format illustrated in DHI Publications Sequence and Formatting for the Hardware Schedule. Include abbreviations and symbols page according to DHI Publications Abbreviations and Symbols. Complete nomenclature of items required for each door opening as indicated.
2. Include lock, latch or trim function (Entry, Classroom, Passage, etc.) in the product description under the Hardware Headings to matching the actual function as indicated by the product catalog number.
3. Coordinate final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of hardware.
4. Architectural Hardware Consultant (AHC), as certified by DHI, who shall affix seal attesting to completeness and correctness, shall review hardware schedule prior to submittal.

D. Submit manufacturer's catalog sheet on design, grade and function of items listed in hardware schedule. Identify specific hardware item per sheet, provide index, and cover sheet.

E. Coordination: Distribute door hardware templates to related divisions within fourteen days of receiving approved door hardware submittals.

F. Electrified Hardware: Provide electrical information to include voltage, and amperage requirements for electrified door hardware and description of operation.
1. Description of operation for each electrified opening to include description of component functions including location, sequence of operation and interface with other building control systems.
2. Wiring Diagrams: Detail wiring for power, signal, and control system and differentiate between manufacturers installed and field installed wiring. Include the following:
   a. System schematic
   b. Point to point wiring diagram
   c. Riser diagram
   d. Elevation of each door
3. Detail interface between electrified door hardware and fire alarm, access control, security, and building control systems.
4. Provide junction boxes, relays and terminal blocks as needed for proper door operations and connections.

G. Upon door hardware submittal approval, furnish for each electrified opening, three copies of point to point diagrams.

H. Closeout Submittals: Submit to Owner in a three ringed binder or CD if requested.
1. Warranties.
2. Maintenance and operating manual.
3. Maintenance service agreement.
4. Record documents.
5. Copy of approved hardware schedule.
6. Copy of approved keying schedule with bitting list.
7. Door hardware supplier name, phone number and fax number.

I. Keying Schedule:
1. Submit (4) four copies of Keying Schedule in compliance with requirements established during Keying Requirements Meeting unless otherwise indicated.

J. Warranty: Submit manufacturer's warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

K. Project Record Documents: Record actual locations of concealed equipment, services, and conduit.

1.05 QUALITY ASSURANCE

A. Standards for Fire-Rated Doors: Maintain one copy of each referenced standard on site, for use by Architect and Contractor.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

C. Installer Qualifications: Company specializing in performing work of the type specified for commercial door hardware with at least three years of documented experience.

D. Supplier Qualifications: Company with certified Architectural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC) to assist in work of this section.

E. Listed and Labeled electrified door hardware as defined in NFPA 70, Article 100, by a testing agency acceptable to authority having jurisdiction.

F. Hardware supplier shall employ an Architectural Hardware Consultant (AHC) as certified by DHI and a member of the seal program who shall be available at reasonable times during course of work for Project hardware consultation.

1. Electrified Door Hardware Supplier Qualifications: Experienced door hardware supplier who has completed projects with electrified door hardware similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in service performance.

G. Door hardware conforming to ICC/ANSI A117.1. : Handles, Pulls, Latches, Locks and operating devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.

H. Fire Rated Door Assemblies: Where fire-rated door assemblies are indicated, provide door hardware rated for use in assemblies complying with NFPA 80 that are listed and or labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to UL 10C, unless otherwise indicated.

I. Fire Door Inspection: Prior to receiving certificate of occupancy have fire rated doors inspected by an independent certified Fire and Egress Door Assembly Inspector (FDAI), as certified by Intertek (ITS), a written report shall be submitted to Owner and Contractor. Doors failing inspection shall be adjusted, replaced or modified to be within appropriate code requirements.

1. Use for buildings under IBC 2009

J. Smoke and Draft Control Door Assemblies: Where smoke and draft control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.

K. Door hardware certified to ANSI/BHMA standards as noted, participate and be listed in BHMA Certified Products Directory.

L. Substitution request: Include the reason for requesting the substitution, clear catalog copy highlighting the proposed product and options, compliance statement, technical data, product warranty and lead time, to show how the proposed can meet or exceed established level of

design function and quality. Approval of request is at the discretion of the owner, architect and their designated consultants.

M. Pre-installation Meeting: Comply with requirements in Division 1 Section "Project Meetings."
   1. Convene meeting seven days before installation. Participants required to attend:
      a. Contractor, installer, material supplier, manufacturer representatives, electrical contractor, security consultant and fire alarm consultant.
   2. Include in conference decisions regarding proper installation methods and procedures for receiving and handling hardware.
   3. Review sequence of operation for each type of electrified door hardware, inspect, and discuss electrical roughing-in and other preparatory work performed by other trades.
   4. Review and finalize construction schedule and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.

N. Within fourteen days of receipt of approved door hardware submittals contact Owner with representative from hardware supplier to establish a keying conference. Verify keyway, visual key identification, number of master keys and keys per lock. Provide keying system per Owners instructions.

O. Installer Qualifications: Specialized in performing installation of this Section and have five years minimum documented experience.

P. Hardware listed in Hardware Schedule is intended to establish type and grade.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Provide clean, dry and secure room for hardware delivered to Project but not yet installed.

B. Furnish hardware with each unit marked and numbered in accordance with approved finish hardware schedule. Include door and item number for each type of hardware.

C. Pack each item complete with necessary parts and fasteners in manufacturer's original packaging.

D. Deliver permanent key, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to Owner shall be established at "Keying Conference."

E. Waste Management and Disposal: Separate waste materials for reuse or recycling in accordance with Division 1.

1.07 WARRANTY

A. See Section 01 77 00 - Closeout Procedures, for additional warranty requirements.

B. General Warranty: Owner may have under provisions of the Contract Documents and be an addition and run concurrent with other warranties made by Contractor under requirements of the Contract documents.

C. Special Warranty: Warranties specified in this article shall not deprive Owner of other rights. .
   1. Ten years for manual door closers.
   2. Five years for mortise, auxiliary and bored locks.
   3. Five years for exit devices.
   4. One year for electromechanical door hardware.

D. Replace or repair defective products during warranty period in accordance with manufacturer's warranty at no cost to Owner. There is no warranty against defects due to improper installation, abuse and failure to exercise normal maintenance.

E. Maintenance Tool and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, removal and replacement of door hardware.

PART 2 PRODUCTS

2.01 DESIGN AND PERFORMANCE CRITERIA

A. Provide specified door hardware as required to make doors fully functional, compliant with applicable codes, and secure to extent indicated.

B. Provide individual items of single type, of same model, and by same manufacturer.

C. Provide door hardware products that comply with the following requirements:
   1. Applicable provisions of federal, state, and local codes.
   2. Fire-Rated Doors: NFPA 80, listed and labeled by qualified testing agency for fire protection ratings indicated, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.
   3. Hardware on Fire-Rated Doors: Listed and classified by UL (DIR), ITS (DIR), or testing firm acceptable to authorities having jurisdiction as suitable for application indicated.

2.02 HINGES

A. Hinges, electric hinges of one manufacturer as listed for continuity of design and consideration of warranty.

B. Standards: Products to be certified and listed by the following:
   1. Butts and Hinges: ANSI/BHMA A156.1
   2. Template Hinge Dimensions: ANSI/BHMA A156.7

C. Butt Hinges:
   1. Hinge weight and size unless otherwise indicated in hardware sets:
      a. Doors up to 36" wide and up to 1-3/4" thick provide hinges with a minimum thickness of .134" and a minimum of 4-1/2" in height.
      b. Doors from 36" wide up to 42" wide and up to 1-3/4" thick provide hinges with a minimum thickness of .145" and a minimum of 4-1/2"" in height.
      c. For doors from 42" wide up to 48" wide and up to 1-3/4" thick provide hinges with a minimum thickness of .180" and a minimum of 5" in height.
      d. Doors greater than 1-3/4" thick provide hinges with a minimum thickness of .180" and a minimum of 5" in height.
      e. Width of hinge is to be minimum required to clear surrounding trim.
   2. Base material unless otherwise indicated in hardware sets:
      a. Exterior Doors: 304 Stainless Steel, Brass or Bronze material.
      b. Interior Doors: Steel material.
      c. Fire Rated Doors: Steel or 304 Stainless Steel materials.
      d. Stainless Steel ball bearing hinges to have stainless steel ball bearings. Steel ball bearings are unacceptable.
   3. Quantity of hinges per door unless otherwise stated in hardware sets:
      a. Doors up to 60"in height provide 2 hinges.
      b. Doors 60" up to 90" in height provide 3 hinges.

c. Doors 90” up to 120” in height provide 4 hinges.
d. Doors over 120” in height add 1 additional hinge per each additional 30” in height.
e. Dutch doors provide 4 hinges.

4. Hinge design and options unless otherwise indicated in hardware sets:
   a. Hinges are to be of a square corner five-knuckle design, flat button tips and have ball bearings unless otherwise indicated in hardware sets.
   b. Out-swinging exterior and out-swinging access controlled doors shall have non-removable pins (NRP) to prevent removal of pin while door is in closed position.
   c. When full width of opening is required, use hinges that are designed to swing door completely from opening when door is opened to 95 degrees.
   d. Electric Through Wire (ETW) to have appropriate number of wires to transfer power through door frame to door for proper connection of finish hardware and certified to handle an amperage rating of 3.5AMPS/continuous duty with 16.0AMPS/intermittent duty.
   e. Provide mortar boxes for frames that require any electrically modified hinges if not an integral part of frame.
   f. When shims are necessary to correct frame or door irregularities, provide metal shims only.
5. Acceptable Manufacturers:
   a. Hager Companies
      1) Standard Weight: BB1279/BB1191
      2) Heavy Weight: BB1168/BB1199
   b. Bommer
      1) Standard Weight: BB5000/BB5002B
      2) Heavy Weight: B5004/BB5006
   c. McKinney
      1) Standard Weight: TA2714/TA2314
      2) Heavy Weight: T4A3786/T4A3386
   d. Ives
      1) Standard Weight: 5BB1
      2) Heavy Weight: 5BB1HW

2.03 CONTINUOUS HINGES

A. Continuous hinges of one manufacturer as listed for continuity of design and consideration of warranty.

B. Standards: Products to be certified and listed by the following: Continuous Hinges: ANSI/BHMA A156.26 Grade 1

C. Continuous Geared Hinges:

D. Determine model number by door and frame application, door thickness, frequency of use, and fire rating requirements according to manufacturer’s recommendations.
   1. Length of hinge shall be 1” less door height unless otherwise stated in hardware sets.

E. Material and Design:

F. Base material: Anodized aluminum manufactured from 6063-T6 material, unexposed working metal surfaces shall be coated with TFE dry lubricant

G. Bearings:
   1. Vertical loads shall be carried on Lubriloy RL bearings for non Fire Rated doors.
      a. Continuous hinges shall have a minimum spacing between bearings of 2-9/16". Typical door from 80" to 84" in height to have a minimum of 32 bearings.
   2. Options:
      a. Removable Electric Through-Wire (RETW) shall have appropriate number of wires to transfer power through door frame to door for proper connection of finish hardware. Provide RETW in a form that can be removed for connection, servicing without removing entire hinge from door and frame, and certified to handle an amperage rating of 3.5AMPS/continuous duty with 16.0AMPS/intermittent duty.
      b. When full width of opening is required, use hinges that are designed to swing door completely from opening when door is opened to 95 degrees.
      c. Fire rated hinges shall carry UL certification, up to and including 90-minute applications for wood doors and up to 3-hour applications for metal doors.

H. Acceptable Manufacturers:
   1. Hager Companies: 780-224HD
   2. Bommer: FM120HD
   3. Zero: 914A
   4. Ives: 112 HD

2.04 FLUSH BOLTS AND COORDINATORS

A. Flushbolts of one manufacturer as listed for continuity of design and consideration of warranty.

B. Standards: Manufacturer to be listed by the following: Auxiliary Hardware: ANSI/BHMA A156.16

C. Labeled openings: Provide automatic or constant latching flush bolts per hardware schedule for inactive leaf of pairs of doors. Provide dust proof strikes for bottom bolt.

D. Non-Labeled openings: Provide two flush bolts for inactive leaf of pairs of doors per hardware schedule. Top bolt shall not be more than 78 inches centerline from floor. Provide dust proof strike for bottom bolt.

E. Acceptable Manufacturers:
   1. Hager Companies
      a. Manual Flush Bolt: 282D
      b. Auto Flush Bolt: 292D/295W/296W
      c. Dust Proof Strike: 280X
   2. Rockwood
      a. Manual Flush Bolt: 555
      b. Auto Flush Bolt: 1942
      c. Dust Proof Strike: 570
   3. Trimco
      a. Manual Flush Bolt: 3917
      b. Auto Flush Bolt: 3815
      c. Dust Proof Strike: 3911
   4. Ives
      a. Manual Flush Bolt: FB458
      b. Auto Flush Bolt: FB31P
      c. Dust Proof Strike: DP1

F. Coordinators: Provide for labeled pairs of doors with automatic flush bolts or with vertical rod exit device with a mortise-locking device per hardware schedule. Provide filler piece to extend full width of stop on frame. Provide mounting brackets for closers and special preparation for latches where applicable.

G. Acceptable Manufacturers:
   1. Hager Companies
      a. Coordinator: 297
      b. Bracket: 297M
      c. Bracket for stops greater than 2-1/2 inches: 297N
   2. Rockwood
      a. Coordinator: 1600
      b. Bracket: 1601AB
      c. Bracket for stops greater than 2-1/2 inches: 1601C
   3. Trimco
      a. Coordinator: 3094
      b. Bracket:3095
      c. Bracket for stops greater than 2-1/2 inches:3096
   4. Ives
      a. Coordinator: COR X FL

2.05 REMOVABLE MULLIONS

A. Keyed and non-keyed removable mullions of one manufacturer as listed for continuity of design and consideration of warranty.

B. Standards: Manufacturer to be listed by the following: UL/cUL/Warnock Hersey for fire rated pairs of doors up to 8 feet tall x 8 feet wide opening.

C. Material and Design:
   1. For use with rim exit devices on non-rated and fire rated pairs of doors. Mullion 2 inch x 3 inch x 11 gage steel tube.
   2. Top Fitting:
      a. Mullion locked in place without use of a key.
      b. Deadlock on fire rated device

D. Acceptable manufacturers for keyed removable mullions:
   1. Hager Companies
      a. Keyed Fire Rated: 4900TF
      b. Keyed Non-Fire Rated: 4900T
   2. Von Duprin
      a. Keyed Fire Rated: KR9954
      b. Keyed Non-Fire Rated: KR4954
   3. Sargent
      a. Keyed Fire Rated: 12-L980
      b. Keyed Non-Fire Rated: L980S

E. Acceptable manufacturers for removable mullions:
   1. Hager Companies
      a. Fire Rated: 4900UF

b. Non-Fire Rated: 4900U
2. Von Duprin
a. Fire Rated: 9954
b. Non-Fire Rated: 4954
3. Sargent
a. Fire Rated: 12-980
b. Non-Fire Rated: 980S

2.06 LOCKS AND LATCHES (GRADE 1 MORTISE)

A. Locks and latches of one manufacturer as listed for continuity of design and consideration of warranty.

B. Standards: Manufacturer to be certified by the following:
1. ANSI/BHMA A156.13 Series 1000 Certified to Grade 1 for Operational and Security.
2. UL/cUL Labeled and listed up to 3 hours for single doors up to 48 inches in width and up to 96 inches in height.
3. UL10C/UBC 7-2 Positive Pressure Rated.
4. ICC/ANSI A117.1.

C. Lock and latch function numbers and descriptions of manufactures series as listed in hardware sets.

D. Material and Design:
1. Lock cases from fully wrapped, 12 gauge steel, Zinc dichromate for corrosion resistance.
2. Non-handed, field reversible without opening lock case.
3. Break away spindles to prevent unlocking during forced entry or vandalism.
4. Levers, Zinc cast, Forged Brass or Stainless Steel and plated to match finish designation in hardware sets.
5. Sectional Roses, solid Brass or Stainless Steel material and have a minimum diameter of 2-7/16 inch.
6. Escutcheons, of solid Brass or Stainless Steel material.
7. Armor fronts, self-adjusting to accommodate a square edge door or a standard 1/8” beveled edge door.

E. Latch and Strike:
1. Stainless Steel latch bolt with minimum of 3/4 inch throw and deadlocking for keyed and exterior functions.
2. Strike is to fit a standard ANSI A115 prep measuring 1-1/4 inches x 4-7/8 inches with proper lip length to protect surrounding trim.
3. Deadbolts to be 1-3/4 inches total length with a minimum of a 1 inch throw and 3/4 inch internal engagement when fully extended and made of Stainless Steel material.

F. Electric Locks
1. Fail Safe (power lock) Outside trim is locked when power is applied and unlocked when power is removed. Lockset will unlock in the event of a power failure. (EL)
2. Fail Secure (power unlock) Outside trim is locked when there’s no power and unlocked when power is applied. Lockset will be locked in the event of a power failure. (EU)
3. Latchbolt monitoring: Single switch SPDT mounted inside lockset monitors full extension of latchbolt. (LM)
4. Door Position Monitor: Single switch SPDT Reed magnetic switch mounted inside lockset monitors whether door is fully closed. (DPM)

5. Request to Exit: Monitors inside lever rotation. (RX)

G. Acceptable Manufacturers:
1. Schlage L9000 series x 06A lever design (No substitution)

2.07 MORTISE DEADBOLTS

A. Mortise deadbolts of one manufacturer as listed for continuity of design and consideration of warranty.

B. Standards: Manufacturer to be certified by the following:

C. ANSI/BHMA A156.13 Series 2000 Grade 1 Operational and Security
1. UL/cUL listed for functions up to 3 hours for "A" label
2. UL10C/UBC 7-2 Positive Pressure Rated
3. ADA - Thumbturn

D. Deadbolt function numbers and descriptions of manufactures series as listed in hardware sets.

E. Material and Design:
1. Latch bolt projection 1 inch throw
2. Case steel, zinc dichromate
3. Armor front 5-9/16 inches, case dimension 4-5/16 inches x 3-9/16 inches x 1 inch

F. Acceptable Manufacturers:
1. Schlage 400 Series (No Substitution)

2.08 EXIT DEVICES (GRADE 1)

A. Exit Devices of one manufacturer as listed for continuity of design and consideration of warranty. Touch pad type, finish to match balance of door hardware

B. Standards: Manufacturer to be certified and or listed by the following:
1. BHMA Certified ANSI A156.3 Grade 1
2. UL/cUL Listed for up to 3 hours for "A" labeled doors
3. UL10C/UBC 7-2 Positive Pressure Rated
4. UL10B Neutral Pressure Rated
5. UL 305Listed for Panic Hardware

C. Material and Design:
1. Touch pad shall extend a minimum of one half-door width. Freewheeling lever design shall match design of locks levers. Exit device to mount flush with door.
2. Latchbolts:
a. Rim device - 3/4 inch throw, Pullman type with automatic dead-latching, stainless steel
b. Surface vertical rod device - Top 1/2 inch throw, Pullman type with automatic dead-latching, stainless steel. Bottom 1/2 inch throw, Pullman type, held retracted during door swing, stainless steel.
3. Fasteners: Wood screws, machine screws and thru-bolts.

D. Lock and Latch Functions: Function numbers and descriptions of manufacturer's series and lever styles indicated in door hardware sets.

E. Acceptable Manufacturers:
1. Von Duprin: 99 Series/ 33 series (No Substitution)

F. Electric Modifications:
   1. Electric Latch Retraction: Continuous duty solenoids retract the latch bolt for momentary or maintained periods of time.
   2. Provide Request to Exit (REX) switches as scheduled.
   3. Electrified Trim: Outside trim locked (EL) or unlocked (EU) by electric current.
   4. Delayed Egress with Wall Mounted Controller (4501 DE)

2.09 CYLINDERS AND KEYING

A. Cylinders and cores of one manufacturer as listed for continuity of design and consideration of warranty.

B. Standards: Manufacturer shall meet the following:
   1. Auxiliary Locks: ANSI/BHMA A156.5
   2. DHI Handbook "Keying systems and nomenclature" (1989)

C. Cylinders:
   1. Match existing Cylinder housing and cores
   2. Furnish with cams/tailpieces as required for locking device that is being furnished for project.

D. Keying:
   1. Conduct a keying meeting the owner's representative, to establish their requirements.
   2. Copy of Owners approved keying schedule submitted to Owner and Architect with documentation of which keying conference was held and Owners sign-off.
   3. Provide a bitting list to Owner of combinations as established, and expand to twenty five percent for future use or as directed by Owner.
   4. Key into Owner's existing keying system.
   5. Keys to be shipped to Owner's representative, individually tag per keying conference.
   6. Provide visual key control identification on keys.

E. Acceptable manufacturers:
   1. Schlage: Locks, Cylinders and Keys. Schlage Everest Primus and Everest Restricted patented full size cylinders - Key to existing factory established Primus masterkey system. (No substitution)

2.10 PUSH/PULL PLATES AND BARS

A. Push/Pull plates and bars of one manufacturer as listed for continuity of design and consideration of warranty.

B. Standards: Manufacturer to be certified by the following:
   1. Architectural Door Trim: ANSI/BHMA A156.6
   2. Americans with Disabilities Act Accessibility Guidelines (ADAAG).

C. Push plates: .050 inch thick, square corner and beveled edges with counter sunk screw holes. Width and height as stated in hardware sets.

D. Acceptable Manufacturers:
   1. Hager Companies: 30S
   2. Rockwood
   3. Trimco
   4. Ives

E. Pull plates: .050 inch thick, square corner and beveled edges. Width and height as stated in hardware sets, 3/4 inch diameter pull, with clearance of 2-1/2 inches from face of door.

F. Acceptable Manufacturers:
   1. Hager Companies: H33J
   2. Rockwood
   3. Trimco
   4. Ives

G. Push Pull Bar Sets: 1 inch round bar stock with 2-1/2 inch clearances from face of door. Offset 3 inches, 90-degree standard. Center to center size should be door width less 1 inch stile width.

H. Acceptable Manufacturers:
   1. Hager Companies: H160D
   2. Rockwood
   3. Trimco
   4. Ives

2.11 CLOSERS (CAST IRON BODY GRADE 1)

A. Closers of one manufacturer as listed for continuity of design and consideration of warranty. Unless otherwise indicated on hardware schedule, comply with manufacturer's recommendation for size of closer, depending on width of door, frequency of use, atmospheric pressure, ADAAG requirements, and fire rating.

B. Standards: Manufacturer to be certified and or listed by the following:
   1. BHMA Certified ANSI A156.4 Grade 1
   2. ADA Compliant ANSI A117.1
   3. UL/cUL Listed up to 3 hours.
   4. UL10C Positive Pressure Rated
   5. UL10B Neutral Pressure Rated

C. Material and Design:
   1. Provide cast iron non-handed bodies with full plastic covers.
   2. Closers shall have separate staked adjustable valve screws for latch speed, sweep speed, and backcheck.
   3. Provide Tri-Pack arms and brackets for regular arm, top jamb, and parallel arm mounting.
   4. One-piece seamless steel spring tube sealed in hydraulic fluid.
   5. Double heat-treated steel tempered springs.
   6. Precision-machined heat-treated steel piston.
   7. Triple heat-treated steel spindle.
   8. Full rack and pinion operation.

D. Mounting:
   1. Out swing doors use surface parallel arm mount closers except where noted on hardware schedule.
   2. In swing doors use surface regular arm mount closers except where noted on hardware schedule.
   3. Provide brackets and shoe supports for aluminum doors and frames to mount fifth screw.
   4. Furnish drop plates where top rail conditions on door do not allow for mounting of closer and where backside of closer is exposed through glass.

E. Size closers in compliance with requirements for accessibility (ADDAG). Comply with following maximum opening force requirements.
   1. Interior hinged openings: 5.0 lbs.
   2. Fire rated and exterior openings use minimum opening force allowable by authority having jurisdiction.

F. Fasteners: Provide self-reaming and self-tapping wood and machine screws and sex nuts and bolts for each closer.

G. Acceptable manufacturers:
   1. LCN: 4000 Series (No Substitution)

2.12 PROTECTIVE TRIM

A. Protective trim of one manufacturer as listed for continuity of design and consideration of warranty.

B. Size of protection plate: Single doors, size two inches less door width (LDW) on push side of door, and one inch less on pull side of door. For pairs of doors, size 1 inch less door width (LDW) on push side of door, and 1/2 inch on pull side of door.
   1. Kickplates 10 inches high or sized to door bottom rail height

C. Standards: Manufacturer shall meet requirements for:
   1. Architectural Door Trim: ANSI/BHMA A156.6
   2. UL

D. Material and Design:
   1. 0.050 inch gage stainless steel
   2. Corners square, polishing lines or dominant direction of surface pattern shall run across door width of plate.
   3. Bevel top, bottom and sides uniformly leaving no sharp edges.
   4. Provide countersink holes for screws for all protection plates. Screws holes shall be spaced equidistant eight inches CTC, along a centerline not over 1/2 inch in from edge around plate. End screws maximum of 0.53 inch from corners.

E. UL label stamp required on protection plates when top of plate is more than 16 inches above bottom of door on fire rated openings. Verify door manufactures UL listing for maximum height and width of protection plate to be used.

F. Acceptable Manufacturers:
   1. Hager Companies: 194S
   2. Trimco
   3. Burns
   4. Ives

2.13 STOPS AND HOLDERS

A. Stops and holders of one manufacturer as listed for continuity of design and consideration of warranty.

B. Wall Stops: Provide door stops wherever necessary to prevent door or hardware from striking an adjacent partition or obstruction. Provide wall stops when possible. Door stops and holders mounted in concrete floor or masonry walls have stainless steel machine screws and lead expansion shields.

C. Standards: Manufacturer shall meet requirements for:
   1. Auxiliary Hardware: ANSI/BHMA A156.16

D. Acceptable Manufacturers:
   1. Hager Companies:
      a. Convex:232W
      b. Cocave: 236W
   2. Rockwood
   3. Burns

E. Overhead Stops and Holders: Provide overhead stop and holders for doors that open against equipment, casework sidelights and other objects that would make wall stops/holders and floor stops/holders inappropriate. Provide sex bolt attachments for mineral core wood door applications.

F. Standards: Manufacturer shall be certified by the following:
   1. Overhead Stops and Holders: ANSI/BHMA A156.8 Grade 1

G. Acceptable Manufacturers:
   1. Hager Companies:
      a. Heavy Duty Surface: 7000 SRF Series
      b. Heavy Duty Concealed: 7000 CON Series
   2. Glynn Johnson:
      a. Heavy Duty Surface: 90 Series
      b. Heavy Duty Concealed: 100 Series
   3. Sargent:
      a. Heavy Duty Surface: 590 Series

2.14 ELECTROMAGNETIC HOLDERS

A. Electromagnetic holders of one manufacturer as listed for continuity of design and consideration of warranty.

B. Standards: Manufacturer shall meet requirements for:
   1. ANSI 156.15 Grade 1
   2. UL/ULC listed
   3. California State Fire Marshall listed (CSFM)
   4. City of New York MEA approved

C. Material and Design:

D. Provide electromagnetic holders where self-closing fire doors and smoke barrier doors are required to be held open. Electromagnetic holders to be fail safe, when electrical current is interrupted, doors release to close automatically. Holding force 25-40 pounds.

E. Acceptable Manufacturers:
   1. Hager Companies: 380 Series
   2. LCN
   3. Rixson

2.15 POWER SUPPLY (FOR FAIL SAFE OR FAIL SECURE LOCKING DEVICES)

A. Power supplies of one manufacturer as listed for continuity of design and consideration of warranty.

B. Standards: Manufacturer shall meet requirements for:
   1. UL Listed

C. Design:
   1. Interface with building alarm controls, card readers, keypads, and other door controls.
   2. Filtered and regulated 24 VDC constant voltage
   3. 2 AMP load capacity
   4. Over voltage/short circuit protection
   5. Surge protection for locking devices
   6. Interface relay
   7. Adjustable time delay

D. Acceptable Manufacturer:
   1. Hager Companies: 2903

2.16 DOOR GASKETING AND WEATHERSTRIP

A. Door gasketing and weather-strip of one manufacturer as listed for continuity of design and consideration of warranty.

B. Provide continuous weather-strip gasketing on exterior doors and provide smoke, light, or sound gasketing where indicated on hardware schedule. Provide non-corrosive fasteners for exterior applications.
   1. Perimeter gasketing: Apply to head and jamb, forming seal between door and frame.
   2. Meeting stile gasketing: Fasten to meeting stiles, forming seal when doors are in closed position.
   3. Door bottoms: Apply to bottom of door, forming seal with threshold or floor when door is in closed position.
   4. Sound Gasketing: Cutting or notching for stop mounted hardware not permitted.
   5. Drip Guard: Apply to exterior face of frame header. Lip length to extend 4” beyond width of door.

C. Standards: Manufacturer shall meet requirements for:
   1. Door Gasketing and Edge Seal Systems: ANSI/BHMA A156.22
   2. BHMA certified for door sweeps, automatic door bottoms, and adhesive applied gasketing. (721)

D. Smoke-Labeled Gasketing: Comply with NFPA 105 listed, labeled, and acceptable to authorities having jurisdiction, for smoke control indicated.
   1. Provide smoke labeled gasketing on 20 minute rated doors and on smoke rated doors.

E. Fire-Rated Gasketing: Comply with NFPA 80 listed, labeled, and acceptable to Authorities Having Jurisdiction, for fire ratings indicated.

F. Refer to Section 08 1416 Wood Doors for Category A or Category B. Comply with UBC 7-2 and UL10C positive pressure where frame applied intumescent seals are required. Provide Hager # 720 for single and 720 x 724 for a pair of doors.

G. Acceptable Manufacturers:
   1. Perimeter Gasketing
      a. Hager Companies:
         1) Adhesive Applied: 726
         2) Stop Applied: 881S
      b. K.N. Crowder:
      c. Reese:
   2. Sound Seal:
      a. Hager Companies:

1) Adhesive Applied: 726-864S
b. K.N. Crowder:
c. Reese:
3. Meeting Stile Weatherstrip:
a. Hager Companies:
1) Adhesive Applied: 872SN
b. K.N. Crowder:
c. Reese:
4. Door Bottom Sweeps:
a. Hager Companies:
1) Adhesive Applied: 770S V
b. K.N. Crowder:
c. Reese:
5. Overhead Drip Guard
a. Hager Companies:
1) Adhesive Applied: 810S
b. K.N. Crowder:
c. Reese:

2.17 THRESHOLDS

A. Thresholds of one manufacturer as listed for continuity of design and consideration of warranty.

B. Set thresholds for exterior and acoustical openings in full bed of sealant with lead expansion shields and stainless steel machine screws complying with requirements specified in Division 7 Section "Joint Sealants". Notched in field to fit frame by hardware installer. Refer to Drawings for special details.

C. Standards: Manufacturer to be certified by the following:
1. Thresholds: ANSI/BHMA A156.21
2. Americans with Disabilities Act Accessibility Guidelines (ADAAG).

D. Acceptable Manufacturers:
1. Hager Companies: 412S
2. K.N. Crowder
3. Reese

2.18 SLIDING DOOR HARDWARE

A. Sliding door hardware of one manufacturer as listed for continuity of design and consideration of warranty.

B. Sliding Door Hardware: Provide complete sets of rails, hangers, supports, bumpers, floor guides, and accessories indicated.

C. Standards: Manufacturer conforms to:
1. Sliding Door Hardware: ANSI/BHMA A156.14

D. Bypassing Sliding Door Hardware: Rated for doors weighing up to 150 lbs.

E. Pocket Sliding Door Hardware: Rated for doors weighing up to 250 lbs.

1. Provide Pocket door kit for pocket doors. Kits are to include header assembly, split studs, hangers, door hanger plates, bumper, guides, floor plate, and end bracket.

F. Wall Mounted Fascia: Rated for doors weighting up to 250 lbs.

G. Acceptable Manufacturers:
1. Hager Companies:
a. By-Pass: 9603
b. Pocket Door Kits: 9850
c. Wall Mounted: 9710
2. Lawrence
3. K.N. Crowder

2.19 SILENCERS

A. Where smoke, light, or weather seal are not required, provide three silencers per single door frame, two per double door frame and four per Dutch door frame.

B. Standards: Manufacturer shall meet requirements for:

C. Auxiliary Hardware: ANSI/BHMA A156.16

D. Acceptable Manufacturers:
1. Hager Companies:
a. Hollow Metal Frame: 307D
b. Wood Frame: 308D
2. Rockwood
3. Trimco

2.20 KEY CABINET

A. Provide key cabinet, surface mounted to wall.

B. Key control system:
1. Include two sets of key tags, hooks, labels, and envelopes.
2. Contain system in metal cabinet with baked enamel finish.
3. Capacity shall be able to hold actual quantities of keys, plus 25 percent.
4. Provide tools, instruction sheets and accessories required to complete installation.

C. Acceptable Manufacturers:
1. Telkey Incorporated
2. Key Control

2.21 FINISHES

A. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if within range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within range of approved Samples.

B. Comply with base material and finish requirements indicated by ANSI/BHMA A156.18 designations in hardware schedule.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that doors and frames are ready to receive this work; labeled, fire-rated doors and frames are properly installed, and dimensions are as indicated on shop drawings.

B. Verify that electric power is available to power operated devices and of correct characteristics.

C. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.

D. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install hardware per manufacturer's instructions and in compliance with:
   1. NFPA 80.
   2. NFPA 105.
   3. ICC/ANSI A117.1.
   4. ANSI/BHMA A156.115 Hardware Preparation in Steel Doors and Steel Frames
   5. ANSI/BHMA A156.115W Hardware Preparation in Wood Doors with Wood or Steel Frames
   6. DHI Publication - Installation Guide for Doors and Hardware
   7. UL10C/UBC7-2
   8. Local building code.
   9. Approved shop drawings.
   10. Approved finish hardware schedule.

B. Do not install surface mounted items until finishes have been completed on substrates involved. Set unit level, plumb and true to line location. Adjust and reinforce attachment substrate as necessary for proper installation and operation

C. Install hardware in accordance with manufacturer's instructions and applicable codes.

D. Install hardware on fire-rated doors and frames in accordance with applicable codes and NFPA 80.

E. Use templates provided by hardware item manufacturer.

F. Door Hardware Mounting Heights: Distance from finished floor to center line of hardware item. As indicated in following list; unless noted otherwise in Door Hardware Schedule or on drawings.

G. Set exterior door thresholds with full-width bead of elastomeric sealant at each point of contact with floor providing a continuous weather seal; anchor thresholds with stainless steel countersunk screws.

3.03 FIELD QUALITY CONTROL

A. Perform field inspection and testing under provisions of Section 01 40 00 - Quality Requirements.

B. Material supplier to schedule final walk through to inspect hardware installation ten business days before final acceptance of Owner. Material supplier shall provide a written report detailing discrepancies of each opening to General Contractor within seven calendar days of walk through.

3.04 ADJUSTING

A. Adjust work under provisions of Section 01 70 00 - Execution and Closeout Requirements.

B. Adjust hardware for smooth operation. Replace items that cannot be adjusted to operate freely and smoothly or as intended for application at no cost to Owner.

C. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.

3.05 CLEANING

A. Clean finished hardware in accordance with manufacturer's written instructions after final adjustments have been made.

B. Clean adjacent surfaces soiled by hardware installation.

C. Replace items that cannot be cleaned to manufacturer's level of finish quality at no additional cost.

D. See Section 01 74 19 - Construction Waste Management and Disposal, for additional requirements.

3.06 PROTECTION

A. Protect finished Work under provisions of Section 01 70 00 - Execution and Closeout Requirements.

B. Do not permit adjacent work to damage hardware or finish.

C. Leave manufacturer’s protective film intact and provide proper protection for all other finish hardware items that do not have protective material from the manufacture until Owner accepts Project as complete.

END OF SECTION

SECTION 08 80 00
GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Insulating glass units.

B. Glazing units.

C. Glazing compounds and accessories.

1.02 RELATED REQUIREMENTS

A. Section 01 74 19 – Construction Waste Management.

B. Section 01 81 13 – Sustainable Design Requirements.

C. Section 01 81 19 – Indoor Air Quality Requirements.

D. Section 08 11 13 - Hollow Metal Doors and Frames: Glazed lites in doors and borrowed lites.

E. Section 08 14 16 - Flush Wood Doors: Glazed lites in doors.

F. Section 08 43 13 - Aluminum-Framed Storefronts: Glazing furnished as part of storefront assembly.

G. Section 08 44 13 - Glazed Aluminum Curtain Walls: Glazing furnished as part of wall assembly.

H. Section 08 51 13 - Aluminum Windows: Glazing furnished by window manufacturer.

1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; current edition.

B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015.

C. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2015).

D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2014a.

E. ASTM C1036 - Standard Specification for Flat Glass; 2016.

F. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.

G. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.

H. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass; 2015.

I. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2016a.

J. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2016.

K. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2010.

L. GANA (SM) - GANA Sealant Manual; 2008.

M. ICC (IBC) - International Building Code; 2015.

N. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use; 1990 (2004).

O. ITS (DIR) - Directory of Listed Products; current edition.

P. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2012.

Q. NFRC 100 - Procedure for Determining Fenestration Product U-factors; 2014.

R. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence; 2014.

S. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems; 2014.

T. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

U. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

V. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

W. UL 263 - Standard for Fire Tests of Building Construction and Materials; Current Edition, Including All Revisions.

1.04 LEED REQUIREMENTS

A. LEED Focus Materials (LFMs) For This Section:
   1. Targeted products containing Recycled Content (MRc4)
   2. Targeted products containing Regional Material (MRc5)

1.05 SUBMITTALS

A. Product Data on Insulating Glass Unit and Glazing Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

B. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.

C. Samples: Submit two samples 12 by 12 inch in size of glass units.

D. Certificate: Certify that products of this section meet or exceed specified requirements.

E. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

F. LEED Product and Material Data Summary Form: For all installed products and materials of this Section, complete the “LEED Product and Material Data Summary Form” (attached to end of Section 01 81 13 - Sustainable Design Requirements)
   1. Product Material Cost: Provide the cost for material, or an assembled product, including taxes and delivery but excluding any cost for labor and equipment required for installation after the material is delivered to the site.
   2. Product Data for Credit MRc4, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating cost for each product having recycled content.

3. Product Data for Credit MRc5, Regional Material: For products having regional materials, documentation indicating location of raw material extraction, harvest or recovery, as well as, manufacture (location of final assembly) within 500 miles of project site. Include statement indicating cost for each material or component of the assembled product.

1.06 QUALITY ASSURANCE

A. Perform Work in accordance with IGMA TM-3000 for glazing installation methods. Maintain one copy on site.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

D. Sustainability and LEED Standards Certification:
   1. Regional manufactured products with percentage by weight.
   2. Recycled content calculated as 1/2 preconsumer + postconsumer.

1.07 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 40 degrees F.

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.08 WARRANTY

A. See Section 01 77 00 - Closeout Procedures, for additional warranty requirements.

B. Insulating Glass Units: Provide a ten (10) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including replacement of failed units.

C. Laminated Glass: Provide a ten (10) year manufacturer warranty to include coverage for delamination, including replacement of failed units.

PART 2 PRODUCTS

2.01 GLAZING TYPE SCHEDULE

Type G1	Insulated Glazing - Vision Glazing, with Low-E Coating
Type G1A	Insulated Glazing - Safety Glazing (fully tempered)
Type G2	Insulated Glazing - Spandrel
Type G3	Monolithic Glazing - Vision Glazing (fully tempered)
Type G4	Fire Rated Glazing - 60 minutes

2.02 MANUFACTURERS

A. Float Glass Manufacturers:
   1. Guardian Industries Corp: www.sunguardglass.com.
   2. Pilkington North America Inc: www.pilkington.com/na.
   3. PPG Industries, Inc: www.ppgideascapes.com.

2.03 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
   1. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
   2. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
   3. Glass thicknesses listed are minimum.

B. Vapor Retarder and Air Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure vapor retarder and air barrier.
   1. In conjunction with vapor retarder and joint sealer materials described in other sections.

C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
   1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
   2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
   3. Solar Optical Properties: Comply with NFRC 300 test method.

2.04 GLASS MATERIALS

A. Float Glass: Provide float glass based glazing unless noted otherwise.
   1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality-Q3.
   2. Heat-Strengthened and Fully Tempered Types: ASTM C1048, Kind HS and FT.
   3. Fully Tempered Safety Glass: Complies with ANSI Z97.1 and 16 CFR 1201 criteria.
   4. Impact Resistant Safety Glass: Complies with ANSI Z97.1 and 16 CFR 1201 criteria; Class B/Category I.

2.05 INSULATING GLASS UNITS

A. Insulating Glass Units: Types as indicated.
   1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
   2. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
   3. Warm-Edge Spacers: Low conductivity thermoplastic and stainless steel.
      a. Spacer Width: As required for specified insulating glass unit.
   4. Spacer Color: Dark gray.
   5. Edge Seal:
      a. Dual-Sealed System: Provide polyisobutylene sealant as primary seal applied between spacer and glass panes, and silicone or polysulfide sealant as secondary seal applied around perimeter.
   6. Color: Black.
   7. Purge interpane space with dry air, hermetically sealed.

2.06 BASIS OF DESIGN - INSULATING GLASS UNITS

A. Type G1 - Vision glazing, with Low-E coating.
   1. Applications: Exterior insulating glass glazing unless otherwise indicated.

2. Space between lites filled with argon.
3. Total Thickness: 1 inch.
4. Thermal Transmittance (U-Value): 0.24, nominal.
5. Visible Light Transmittance (VLT): 74 percent, nominal.
6. Solar Heat Gain Coefficient (SHGC): 0.41, nominal.
7. Glazing Method: Dry glazing method, gasket glazing.
8. Basis of Design - Guardian Glass, LLC: www.guardianglass.com.
9. Outboard Lite: Annealed float glass, 1/4 inch thick, minimum.
   a. Low-E Coating: SunGuard SNX 62/27 on #2 surface.
10. Inboard Lite: Annealed float glass, 1/4 inch thick.
    a. Coating: No coating on inboard lite.
    b. Glass: Clear.

B. Type G1A -Sealed Insulating Glass Units: Safety glazing:
1. Applications: Provide this type of glazing in the following locations:
   a. Glazed lites in exterior doors.
   b. Glazed sidelights and panels next to doors.
   c. Other locations required by applicable federal, state, and local codes and regulations.
   d. Other locations indicated on the drawings.
2. Type: Same as Type 1 except use fully tempered float glass for both outboard and inboard lites.

C. Type G2 - Spandrel glazing.
1. Applications: Exterior spandrel glazing unless otherwise indicated.
2. Space between lites filled with argon.
3. Basis of Design - Guardian Glass, LLC: www.guardianglass.com.
4. Outboard Lite: Heat-strengthened float glass, 1/4 inch thick, minimum.
   a. Tint: Clear.
   b. Coating: Same as on vision units, on #2 surface.
5. Inboard Lite: Fully tempered float glass, 1/4 inch thick.
   a. Tint: Clear.
   b. Opacifier: Ceramic frit, on #3 surface.
   c. Opacifier Color: as selected by Architect from manufacturer's full range.
   d. Coating: OpaciCoat 300.
6. Total Thickness: 1 inch.

D. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of another acceptable manufacturer.

E. Substitution Procedures: See Section 01 60 00 - Product Requirements.
1. For any product not identified as "Basis of Design", submit information as specified for substitutions.

2.07 GLAZING UNITS

A. Type G3 - Monolithic Interior Vision Glazing:
1. Applications: Interior glazing unless otherwise indicated.
2. Glass Type: Fully tempered float glass.
3. Tint: Clear.
4. Thickness: 1/4 inch, nominal.

5. Locations: Interior vision panels, doors and sidelites.

B. Type G4 - Fire-Resistance-Rated Glazing: Type, thickness, and configuration of glazing that contains flame, smoke, and blocks radiant heat, as required to achieve indicated fire-rating period of 60 minutes.
   1. Applications:
      a. Glazing in fire-rated window assembly.
   2. Provide products listed by ITS (DIR) or UL (DIR) and approved by authorities having jurisdiction.
   3. Safety Glazing Certification: 16 CFR 1201 Category II.
   4. Fire-Rating Period: 60 minutes.
   5. Product: Pilkington Pyrostop
   6. Nominal Thickness: 7/8 inch.
   7. Markings for Fire-Resistance-Rated Glazing Assemblies: Provide permanent markings on fire-resistance-rated glazing in compliance with ICC (IBC), local building code, and authorities having jurisdiction.
      a. "W" - meets wall assembly criteria of ASTM E119 or UL 263 fire test standards.
      b. "D" - meets fire door assembly criteria of NFPA 252, UL 10B, or UL 10C fire test standards.
      c. "H" - meets fire door assembly hose stream test of NFPA 252, UL 10B, or UL 10C fire test standards.
      d. "T" - meets temperature rise of not more than 450 degrees F above ambient at end of 30 minutes fire exposure in accordance with NFPA 252, UL 10B, or UL 10C fire test standards.
      e. "XXX" - placeholder that represents fire-rating period, in minutes.
   8. Products:
      a. SAFTIFIRST, a division of O'Keeffe's Inc; SuperLite II-XL 60: www.safti.com/#sle.
      b. Technical Glass Products; Pilkington Pyrostop 60: www.fireglass.com/#sle.
      c. Substitutions: Refer to Section 01 60 00 - Product Requirements.

2.08 GLAZING COMPOUNDS

A. Butyl Sealant: Single component; ASTM C920, Grade NS, Class 12-1/2, Uses M and A, Shore A hardness of 10 to 20; black color.

B. Polysulfide Sealant: Two component; chemical curing, non-sagging type; ASTM C920, Type M, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; color as selected.

C. Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C920, Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; clear color.

2.09 ACCESSORIES

A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch x width of glazing rabbet space minus 1/16 inch x height to suit glazing method and pane weight and area.

B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Minimum 3 inch long x one half the height of the glazing stop x thickness to suit application, self adhesive on one face.

C. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.
   1. Width: As required for application.
   2. Thickness: As required for application.

D. Glazing Gaskets: Resilient silicone extruded shape to suit glazing channel retaining slot; color black.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.

B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

C. Verify that sealing between joints of glass framing members has been completed effectively.

D. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean contact surfaces with appropriate solvent and wipe dry immediately before glazing. Remove coatings that are not tightly bonded to substrates.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION, GENERAL

A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.

B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.

C. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.

D. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.

E. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.

F. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, etc.

3.04 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)

A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.

B. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.

C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.

D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.05 INSTALLATION - PRESSURE GLAZED SYSTEMS

A. Application - Exterior Glazed: Set glazing infills from the exterior of the building.

B. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.

C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.

D. Install pressure plates without displacing glazing gasket; exert pressure for full continuous contact.

E. Install cover plate.

3.06 FIELD QUALITY CONTROL

A. Glass and Glazing product manufacturers to provide field surveillance of the installation of their products.

B. Monitor and report installation procedures and unacceptable conditions.

3.07 CLEANING

A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.

B. Remove non-permanent labels immediately after glazing installation is complete.

C. Clean glass and adjacent surfaces after sealants are fully cured.

D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.08 PROTECTION

A. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION

SECTION 09 05 61
COMMON WORK RESULTS FOR FLOORING PREPARATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section applies to floors identified in contract documents that are receiving the following types of floor coverings:
   1. Resilient tile and sheet.
   2. Broadloom carpet.
   3. Carpet tile.
   4. Thin-set ceramic tile and stone tile.
   5. Terrazzo.
   6. Textile composite flooring.

B. Removal of existing floor coverings.

C. Preparation of existing concrete floor slabs for installation of floor coverings.

D. Testing of concrete floor slabs for moisture and alkalinity (pH).

E. Remediation of concrete floor slabs due to unsatisfactory moisture or alkalinity (pH) conditions.
   1. Contractor shall perform all specified remediation of concrete floor slabs. If such remediation is indicated by testing agency's report and is due to a condition not under Contractor's control or could not have been predicted by examination prior to entering into the contract, a contract modification will be issued.

F. Patching compound.

G. Remedial floor coatings.

1.02 RELATED REQUIREMENTS

A. Section 01 74 19 – Construction Waste Management.

B. Section 01 81 13 – Sustainable Design Requirements.

C. Section 01 81 19 – Indoor Air Quality Requirements.

D. Section 03 54 00 - Cast Underlayment: Self-leveling underlayment applied as remediation treatment.

1.03 REFERENCE STANDARDS

A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens); 2016a.

B. ASTM C472 - Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters and Gypsum Concrete; 1999 (Reapproved 2014).

C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2011.

D. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2011.

E. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings; Resilient Floor Covering Institute; October 2011.

1.04 LEED REQUIREMENTS

A. LEED Focus Materials (LFMs) For This Section:
   1. Targeted products containing Recycled Content (MRc4)
   2. Targeted products containing Regional Material (MRc5)

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordinate scheduling of cleaning and testing, so that preliminary cleaning has been completed for at least 24 hours prior to testing.

1.06 SUBMITTALS

A. Visual Observation Report: For existing floor coverings to be removed.

B. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:
   1. Moisture and alkalinity (pH) limits and test methods.
   2. Manufacturer's required bond/compatibility test procedure.

C. Testing Agency's Report:
   1. Description of areas tested; include floor plans and photographs if helpful.
   2. Summary of conditions encountered.
   3. Moisture and alkalinity (pH) test reports.
   4. Copies of specified test methods.
   5. Recommendations for remediation of unsatisfactory surfaces.
   6. Submit report to Architect.
   7. Submit report not more than two business days after conclusion of testing.

D. Adhesive Bond and Compatibility Test Report.

E. Copy of RFCI (RWP).

F. Remedial Materials Product Data: Manufacturer's published data on each product to be used for remediation.
   1. Manufacturer's installation instructions.
   2. Specimen Warranty: Copy of warranty to be issued by coating manufacturer and certificate of underwriter's coverage of warranty.

G. LEED Product and Material Data Summary Form: For all installed products and materials of this Section, complete the “LEED Product and Material Data Summary Form” (attached to end of Section 01 81 13 - Sustainable Design Requirements)
   1. Product Material Cost: Provide the cost for material, or an assembled product, including taxes and delivery but excluding any cost for labor and equipment required for installation after the material is delivered to the site.
   2. Product Data for Credit MRc4, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating cost for each product having recycled content.
   3. Product Data for Credit MRc5, Regional Material: For products having regional materials, documentation indicating location of raw material extraction, harvest or recovery, as well as, manufacture (location of final assembly) within 500 miles of project site. Include statement indicating cost for each material or component of the assembled product.

1.07 QUALITY ASSURANCE

A. Moisture and alkalinity (pH) testing shall be performed by an independent testing agency employed and paid by Contractor.

B. Testing Agency Qualifications: Independent testing agency experienced in the types of testing specified.
   1. Submit evidence of experience consisting of at least 3 test reports of the type required, with project Owner's project contact information.

C. Contractor's Responsibility Relating to Independent Agency Testing:
   1. Provide access for and cooperate with testing agency.
   2. Confirm date of start of testing at least 10 days prior to actual start.
   3. Allow at least 4 business days on site for testing agency activities.
   4. Achieve and maintain specified ambient conditions.
   5. Notify Architect when specified ambient conditions have been achieved and when testing will start.

D. Remedial Coating Installer Qualifications: Company specializing in performing work of the type specified in this section, trained by or employed by coating manufacturer, and able to provide at least 3 project references showing at least 3 years' experience installing moisture emission coatings.

E. Sustainability and LEED Standards Certification:
   1. Regional manufactured products with percentage by weight.
   2. Recycled content calculated as 1/2 preconsumer + postconsumer.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, handle, and protect products in accordance with manufacturer’s instructions and recommendations.

B. Deliver materials in manufacturer’s packaging; include installation instructions.

C. Keep materials from freezing.

1.09 FIELD CONDITIONS

A. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 65 degrees F or more than 85 degrees F.

B. Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.

PART 2 PRODUCTS

2.01 MATERIALS

A. Patching Compound: Floor covering manufacturer's recommended product, suitable for conditions, and compatible with adhesive and floor covering. In the absence of any recommendation from flooring manufacturer, provide a product with the following characteristics:
   1. Cementitious moisture-, mildew-, and alkali-resistant compound, compatible with floor, floor covering, and floor covering adhesive, and capable of being feathered to nothing at edges.

2. Compressive Strength: 3000 psi, minimum, after 28 days, when tested in accordance with ASTM C109/C109M or ASTM C472, whichever is appropriate.

B. Alternate Flooring Adhesive: Floor covering manufacturer's recommended product, suitable for the moisture and pH conditions present; low-VOC. In the absence of any recommendation from flooring manufacturer, provide a product recommended by adhesive manufacturer as suitable for substrate and floor covering and for conditions present.

C. Remedial Floor Coating: Single- or multi-layer coating or coating/overlay combination intended by its manufacturer to resist water vapor transmission to degree sufficient to meet flooring manufacturer's emission limits, resistant to the level of alkalinity (pH) found, and suitable for adhesion of flooring without further treatment.

PART 3 EXECUTION

3.01 CONCRETE SLAB PREPARATION

A. Perform following operations in the order indicated:
   1. Existing concrete slabs (on-grade and elevated) with existing floor coverings:
      a. Visual observation of existing floor covering, for adhesion, water damage, alkaline deposits, and other defects.
      b. Removal of existing floor covering.
   2. Preliminary cleaning.
   3. Moisture vapor emission tests; 3 tests in the first 1000 square feet and one test in each additional 1000 square feet, unless otherwise indicated or required by flooring manufacturer.
   4. Alkalinity (pH) tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
   5. Specified remediation, if required.
   6. Patching, smoothing, and leveling, as required.
   7. Other preparation specified.
   8. Adhesive bond and compatibility test.
   9. Protection.

B. Remediations:
   1. Active Water Leaks or Continuing Moisture Migration to Surface of Slab: Correct this condition before doing any other remediation; re-test after correction.
   2. Excessive Moisture Emission or Relative Humidity: If an adhesive that is resistant to the level of moisture present is available and acceptable to flooring manufacturer, use that adhesive for installation of the flooring; if not, apply remedial floor coating or remedial sheet membrane over entire suspect floor area.
   3. Excessive Alkalinity (pH): If remedial floor coating is necessary to address excessive moisture, no additional remediation is required; if not, if an adhesive that is resistant to the level present is available and acceptable to the flooring manufacturer, use that adhesive for installation of the flooring; otherwise, apply a skim coat of specified patching compound over entire suspect floor area.

3.02 REMOVAL OF EXISTING FLOOR COVERINGS

A. Comply with local, State, and federal regulations and recommendations of RFCI Recommended Work Practices for Removal of Resilient Floor Coverings, as applicable to floor covering being removed.

B. Dispose of removed materials in accordance with local, State, and federal regulations and as specified.

3.03 MOISTURE VAPOR EMISSION TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.

B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.

C. Test in accordance with ASTM F1869 and as follows.

D. Plastic sheet test and mat bond test may not be substituted for the specified ASTM test method, as those methods do not quantify the moisture content sufficiently.

E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if test values exceed 3 pounds per 1000 square feet per 24 hours.

F. Report: Report the information required by the test method.

3.04 ALKALINITY (PH) TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.

B. The following procedure is the equivalent of that described in ASTM F710, repeated here for the Contractor's convenience.

C. Use a wide range alkalinity (pH) test paper, its associated chart, and distilled or deionized water.

D. Place several drops of water on a clean surface of concrete, forming a puddle approximately 1 inch in diameter. Allow the puddle to set for approximately 60 seconds, then dip the alkalinity (pH) test paper into the water, remove it, and compare immediately to chart to determine alkalinity (pH) reading.

E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if alkalinity (pH) test value is over 10.

3.05 PREPARATION

A. See individual floor covering section(s) for additional requirements.

B. Comply with requirements and recommendations of floor covering manufacturer.

C. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with patching compound.

D. Do not fill expansion joints, isolation joints, or other moving joints.

3.06 ADHESIVE BOND AND COMPATIBILITY TESTING

A. Comply with requirements and recommendations of floor covering manufacturer.

3.07 APPLICATION OF REMEDIAL FLOOR COATING

A. Comply with requirements and recommendations of coating manufacturer.

END OF SECTION

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SECTION 09 21 16
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.

B. Metal stud wall framing.

C. Metal channel ceiling framing.

D. Gypsum sheathing.

E. Cementitious backing board.

F. Gypsum wallboard.

G. Joint treatment and accessories.

1.02 RELATED REQUIREMENTS

A. Section 01 74 19 – Construction Waste Management.

B. Section 01 81 13 – Sustainable Design Requirements.

C. Section 01 81 19 – Indoor Air Quality Requirements.

D. Section 06 10 00 - Rough Carpentry: Wood blocking product and execution requirements.

E. Section 07 21 00 - Thermal Insulation: Acoustic insulation.

F. Section 07 84 00 - Firestopping: Top-of-wall assemblies at fire rated walls.

G. Section 07 92 00 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

1.03 REFERENCE STANDARDS

A. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2010 (Reaffirmed 2016).

B. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2015.

C. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2014.

D. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2017.

E. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2016.

F. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2015.

G. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2016.

H. ASTM C1047 - Standard Specification for Accessories For Gypsum Wallboard and Gypsum Veneer Base; 2014a.

I. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2013.

J. ASTM C1278/C1278M - Standard Specification for Fiber-Reinforced Gypsum Panel; 2007a (Reapproved 2015).

K. ASTM C1280 - Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing; 2013a.

L. ASTM C1325 - Specification for Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units; 2017.

M. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2014a.

N. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels; 2015.

O. ASTM C1658/C1658M - Standard Specification for Glass Mat Gypsum Panels; 2013.

P. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2016.

Q. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).

R. ASTM E413 - Classification for Rating Sound Insulation; 2016.

S. GA-216 - Application and Finishing of Gypsum Board; 2016.

T. GA-226 - Application of Gypsum Board to Form Curved Surfaces; Gypsum Association; 2016.

U. UL (FRD) - Fire Resistance Directory; current edition.

1.04 LEED REQUIREMENTS

A. LEED Focus Materials (LFMs) For This Section:
   1. Targeted products containing Recycled Content (MRc4)
   2. Targeted products containing Regional Material (MRc5)

1.05 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.

C. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

D. Test Reports: For stud framing products that do not comply with ASTM C645 or ASTM C754, provide independent laboratory reports showing maximum stud heights at required spacings and deflections.

E. LEED Product and Material Data Summary Form: For all installed products and materials of this Section, complete the “LEED Product and Material Data Summary Form” (attached to end of Section 01 81 13 - Sustainable Design Requirements)
   1. Product Material Cost: Provide the cost for material, or an assembled product, including taxes and delivery but excluding any cost for labor and equipment required for installation after the material is delivered to the site.
   2. Product Data for Credit MRc4, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating cost for each product having recycled content.

3. Product Data for Credit MRc5, Regional Material: For products having regional materials, documentation indicating location of raw material extraction, harvest or recovery, as well as, manufacture (location of final assembly) within 500 miles of project site. Include statement indicating cost for each material or component of the assembled product.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum 5 years of experience.

B. Sustainability and LEED Standards Certification:
   1. Regional manufactured products with percentage by weight.
   2. Recycled content calculated as 1/2 preconsumer + postconsumer.
   3. VOC content limitations defined in Section 018114, "Volatile Organic Compound (VOC) Limits For Adhesives, Sealants, Paints, and Coatings."

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.

B. Interior Partitions: Provide completed assemblies with the following characteristics:
   1. Acoustic Attenuation: STC as indicated calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

C. Fire Rated Assemblies: Provide completed assemblies with the following characteristics:
   1. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL (FRD). Refer to drawings for UL Assembly Numbers.

2.02 METAL FRAMING MATERIALS

A. Manufacturers - Metal Framing, Connectors, and Accessories:
   1. Clarkwestern Dietrich Building Systems LLC: www.clarkdietrich.com.
   2. Marino: www.marinoware.com.
   3. Phillips Manufacturing Co: www.phillipsmfg.com/#sle.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/120 at 5 psf.
   1. Studs: "C" shaped with flat or formed webs with knurled faces.
   2. Runners: U shaped, sized to match studs.
   3. Ceiling Channels: C-shaped.
   4. Furring: Hat-shaped sections, minimum depth of 7/8 inch.

C. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.

D. Partition Head To Structure Connections: Provide track fastened to structure with legs of sufficient length to accommodate deflection, for friction fit of studs cut short and fastened as indicated on drawings.

2.03 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
   1. CertainTeed Corporation: www.certainteed.com.

2. Georgia-Pacific Gypsum: www.gpgypsum.com.
3. National Gypsum Company: www.nationalgypsum.com/#sle.
4. USG Corporation: www.usg.com.
5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
1. Application: Use for vertical surfaces and ceilings 8'-0" and higher, unless otherwise indicated. Use for inner layer of multi-layer applications, unless otherwise indicated.
2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   a. Mold resistant board is required at all locations.
3. At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
4. Thickness:
   a. Vertical Surfaces: 5/8 inch.
   b. Ceilings: 5/8 inch.

C. Abuse Resistant Wallboard:
1. Application: at all gypsum board partitions, 9 feet and below..
2. Surface Abrasion: Level 2, minimum, when tested in accordance with ASTM C1629/C1629M.
3. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
4. Unfaced Type: Interior fiber-reinforced gypsum panels as defined in ASTM C1278/C1278M.
5. Type: Fire resistance rated Type X, UL or WH listed.
6. Thickness: 5/8 inch.
7. Edges: Tapered.
8. Products:
   a. USG Corporation; Fiberock Aqua-Tough Interior Panel.
   b. Substitutions: See Section 01 60 00 - Product Requirements.

D. Backing Board For Non-Wet Areas: Water-resistant gypsum backing board as defined in ASTM C1396/C1396M; sizes to minimum joints in place; ends square cut.
1. Application: Vertical surfaces behind thinset tile, except in wet areas. Vertical surfaces behind prefab shower.
2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
3. At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
4. Type: Type X, in locations indicated.
5. Type X Thickness: 5/8 inch.
6. Edges: Tapered.
7. Products:
   a. National Gypsum Company; Gold Bond Hi-Impact XP Gypsum Board.
   b. Georgia-Pacific Gypsum; DensShield Tile Backer.
   c. USG Corporation; Fiberock Aqua-Tough Interior Panel
   d. Substitutions: See Section 01 60 00 - Product Requirements.

E. Exterior Sheathing Board: Sizes to minimize joints in place; ends square cut.
1. Application: Exterior sheathing, unless otherwise indicated.
2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.

3. Glass Mat Faced Sheathing: Glass mat faced gypsum substrate as defined in ASTM C1177/C1177M.
4. Core Type: Type X.
5. Type X Thickness: 5/8 inch.
6. Edges: Square.
7. Glass Mat Faced Products:
   a. Georgia-Pacific Gypsum; DensGlass Sheathing.
   b. National Gypsum Company; Gold Bond eXP Sheathing.
   c. Certainteed Corporation; GlasRoc Brand.
   d. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 ACCESSORIES

A. Acoustic Insulation: As specified in Section 07 21 00.

B. Acoustic Sealant: As specified in Section 07 92 00; Type 5

C. Water-Resistive Barrier: As specified in Section 07 25 00.

D. Finishing Accessories: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.
   1. Types: As detailed or required for finished appearance.

E. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
   1. Tape: 2 inch wide, coated glass fiber tape for joints and corners, except as otherwise indicated.
   2. Tape: 2 inch wide, creased paper tape for joints and corners, except as otherwise indicated.
   3. Chemical hardening type compound.

F. High Build Drywall Surfacer: Vinyl acrylic latex-based coating for spray application, designed to take the place of skim coating and separate paint primer in achieving Level 5 finish.
   1. Products:
      a. USG Sheetrock Brand Tuff-Hide Primer-Surfacer.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

G. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inch in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion resistant.

H. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws, corrosion resistant.

I. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.

B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.

1. Level ceiling system to a tolerance of 1/1200.
2. Laterally brace entire suspension system.

C. Studs: Space studs at 16 inches on center.
1. Extend partition framing to structure where indicated and to ceiling in other locations.
2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
3. Partitions Terminating at Structure: Attach extended leg top runner to structure, maintain clearance between top of studs and structure, and brace both flanges of studs with continuous bridging.

D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.

E. Blocking: Install wood blocking for support of:
1. Framed openings.
2. Wall mounted cabinets.
3. Plumbing fixtures.
4. Toilet partitions.
5. Toilet accessories.
6. Wall mounted door hardware, including wall stops.
7. Handrails and wall brackets.
8. Display cases, markerboards, tack boards.
9. TV and monitor mounts.

3.03 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

B. Acoustic Sealant: Install in accordance with manufacturer's instructions.
1. Place two beads continuously on substrate before installation of perimeter framing members.
2. Place continuous bead at perimeter of each layer of gypsum board.
3. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

3.04 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Single-Layer Non-Rated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.

C. Double-Layer Non-Rated: Use gypsum board for first layer, placed perpendicular to framing or furring members, with ends and edges occurring over firm bearing. Place second layer parallel to framing or furring members. Offset joints of second layer from joints of first layer.

D. Fire-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

E. Exterior Sheathing: Comply with ASTM C1280. Install sheathing vertically, with edges butted tight and ends occurring over firm bearing.
1. Paper-Faced Sheathing: Immediately after installation, protect from weather by application of water-resistive barrier.

F. Cementitious Backing Board: Install over steel framing members and plywood substrate where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.

G. Installation on Metal Framing: Use screws for attachment of gypsum board.

H. Curved Surfaces: Apply gypsum board to curved substrates in accordance with GA-226.

3.05 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
   1. Not more than 30 feet apart on walls and ceilings over 50 feet long.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.06 JOINT TREATMENT

A. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
   1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
   2. Level 1: Fire rated wall areas above finished ceilings, whether or not accessible in the completed construction.

B. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
   1. Feather coats of joint compound so that camber is maximum 1/32 inch.

C. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

3.07 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION

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SECTION 09 30 00
TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tile for floor applications.

B. Tile for wall applications.

C. Solid surface thresholds.

D. Non-ceramic trim.

E. Trim.

1.02 RELATED REQUIREMENTS

A. Section 01 74 19 – Construction Waste Management.

B. Section 01 81 13 – Sustainable Design Requirements.

C. Section 01 81 14 – Volatile Organic Compound (VOC) Limits For Adhesives, Sealants, Paints & Coatings.

D. Section 01 81 19 – Indoor Air Quality Requirements.

E. Section 07 92 00 - Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.

F. Section 09 21 16 - Gypsum Board Assemblies: Tile backer board.

1.03 REFERENCE STANDARDS

A. ANSI A108/A118/A136.1 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium); 2017.

B. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar; 2014.

C. ANSI A108.1b - American National Standard Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).

D. ANSI A108.1c - Specifications for Contractors Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Bed with Dry-Set or Latex-Portland Cement; 1999 (Reaffirmed 2010).

E. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile-Setting Epoxy Adhesive; 2009 (Revised).

F. ANSI A108.5 - American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).

G. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy; 1999 (Reaffirmed 2010).

H. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout; 1999 (Reaffirmed 2010).

I. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout; 1999 (Reaffirmed 2010).

J. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework; 1999 (Reaffirmed 2010).

K. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2010 (Reaffirmed 2016).

L. ANSI A108.12 - American National Standard for Installation of Ceramic Tile with EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).

M. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone; 2005 (Reaffirmed 2010).

N. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar; 2012 (Revised).

O. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation; 2010 (Revised).

P. ANSI A118.15 - American National Standard Specifications for Improved Modified Dry-Set Cement Mortar; 2012.

Q. ANSI A137.1 - American National Standard Specifications for Ceramic Tile; 2013.1.

R. ASTM C373 - Standard Test Method for Water Absorption, Bulk Density, Apparent Porosity, and Apparent Specific Gravity of Fired Whiteware Products, Ceramic Tiles, and Glass Tiles; 2014a.

S. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2016.

1.04 LEED REQUIREMENTS

A. LEED Focus Materials (LFMs) For This Section:
   1. Targeted products containing Recycled Content (MRc4)
   2. Targeted products containing Regional Material (MRc5)
   3. Targeted products to meet VOC requirements (EQc4.1 & EQc4.2)
   4. Targeted products to meet Low Emitting Flooring requirements (EQc4.3)

1.05 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.

C. Samples: Mount tile and apply grout on two plywood panels, minimum 24 by 24 inches in size illustrating pattern, color variations, and grout joint size variations.

D. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.

E. LEED Product and Material Data Summary Form: For all installed products and materials of this Section, complete the “LEED Product and Material Data Summary Form” (attached to end of Section 01 81 13 - Sustainable Design Requirements)
   1. Product Material Cost: Provide the cost for material, or an assembled product, including taxes and delivery but excluding any cost for labor and equipment required for installation after the material is delivered to the site.

2. Product Data for Credit MRc4, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating cost for each product having recycled content.
3. Product Data for Credit MRc5, Regional Material: For products having regional materials, documentation indicating location of raw material extraction, harvest or recovery, as well as, manufacture (location of final assembly) within 500 miles of project site. Include statement indicating cost for each material or component of the assembled product.
4. Product Data for Credit EQc4.1, Adhesives & Sealants: For adhesives and sealants, documentation including printed statement of VOC content and chemical components.
5. Product Data for Credit EQc4.3, Flooring: Certificates from product manufacturer or testing agency for flooring products indicating that they comply with the applicable standards.

1.06 QUALITY ASSURANCE

A. Maintain one copy of and ANSI A108/A118/A136.1 and TCNA (HB) on site.

B. Installer Qualifications: Company specializing in performing tile installation, with minimum of five years of documented experience.

C. Sustainability and LEED Standards Certification:
1. Regional manufactured products with percentage by weight.
2. Recycled content calculated as 1/2 preconsumer + postconsumer.
3. VOC content limitations defined in Section 018114, "Volatile Organic Compound (VOC) Limits For Adhesives, Sealants, Paints, and Coatings."
4. Low Emitting Flooring certification.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Do not install solvent-based products in an unventilated environment.

B. Maintain ambient and substrate temperature of 50 degrees F during installation of mortar materials.

PART 2 PRODUCTS

2.01 TILE

A. Quarry Tile: ANSI A137.1, standard grade.
1. Moisture Absorption: over 3.0 but not more than 5.0 percent as tested in accordance with ASTM C373.
2. Size: 8 by 8 inch, nominal.
3. Thickness: 1/2 inch, nominal.
4. Edges: Square.
5. Surface Finish: Unglazed.
6. Color(s): As indicated on drawings.
7. Pattern: grid pattern.
8. Trim Units: Matching cove base shapes in sizes indicated.

9. Products:
    a. Basis of Design: Summitville Tiles, Inc: www.summitville.com.
    b. Substitutions: See Section 01 60 00 - Product Requirements.

B. Porcelain Floor Tile, Type PFT-1, PFT-2, PFT-3, PFT-4: ANSI A137.1, standard grade.
1. Size: 12 by 24 inch, nominal.
2. Edges: Square.
3. Surface Finish: Natural.
4. Color(s): As indicated on drawings.
5. Pattern: As indicated on drawings.
6. Trim Units: Matching cove base shapes in sizes indicated.
7. Products:
    a. Basis of Design : Crossville Inc. : www.crossvilleinc.com.
    b. Substitutions: See Section 01 60 00 - Product Requirements.

C. Porcelain Wall Tile, Type PWT-1, PWT-2: ANSI A137.1, standard grade.
1. Size: 12 by 24 inch, nominal.
2. Edges: Square.
3. Surface Finish: Natural.
4. Color(s): As indicated on drawings.
5. Pattern: As indicated on drawings.
6. Products:
    a. Basis of Design : Crossville Inc. : www.crossvilleinc.com.
    b. Substitutions: See Section 01 60 00 - Product Requirements.

D. Ceramic Wall Tile, Type CWT-1, CWT-2, CWT-3: ANSI A137.1, standard grade.
1. Size: 4 by 8 inch, nominal.
2. Thickness: 1/4 inch.
3. Edges: Square.
4. Surface Finish: Gloss.
5. Color(s): As indicated on drawings.
6. Pattern: As indicated on drawings.
7. Products:
    a. Basis of Design : Crossville Inc. : www.crossvilleinc.com.
    b. Substitutions: See Section 01 60 00 - Product Requirements.

E. Ceramic Wall Tile, Type CWT-4: ANSI A137.1, standard grade.
1. Size: 6 by 6 inch, nominal.
2. Thickness: 5/16 inch.
3. Edges: Square.
4. Surface Finish: Matte.
5. Color(s): As indicated on drawings.
6. Pattern: As indicated on drawings.
7. Products:
    a. Basis of Design : Daltile : www.daltile.com.
    b. Substitutions: See Section 01 60 00 - Product Requirements.

F. Glass Mosaic Wall Tile, Type GMT-1: ANSI A137.1, standard grade.
1. Size: 1/2 by 12 inch, nominal.
2. Thickness: 1/4 inch.

3. Edges: Square.
4. Color(s): As indicated on drawings.
5. Pattern: As indicated on drawings.
6. Products:
   a. Basis of Design : Crossville Inc. : www.crossvilleinc.com.
   b. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 TRIM AND ACCESSORIES

A. Metal Trim: Stainless Steel, style and dimensions to suit application, for setting using tile mortar or adhesive.
   1. Applications:
      a. Open edges of wall tile.
      b. Wall corners, outside and inside.
      c. Floor to wall joints.
   2. Manufacturers:
      a. Schluter-Systems: www.schluter.com.
         1) Cove: DILEX-EHK
         2) Corner: Scheine
      b. Genesis APS International: www.genesis-aps.com.
         1) Cove: Internal Trim EWA
         2) Corner: ESS - Straight Edge Trim

B. Thresholds: Solid Surface 4 inches wide by full swidth of wall of frame opening, thickness to fit application and meeting ADA requirements; beveled one long edge with radused corners on top sides. Colors: Group A or manufacturer's standard
   1. Applications: Provide at the following locations:
      a. At doorways where tile terminates.
      b. At open edges of floor tile where adjacent finish is a different height.

2.03 SETTING MATERIALS

A. Latex-Portland Cement Mortar Bond Coat: ANSI A118.4.
   1. Applications: Use this type of bond coat where indicated and where no other type of bond coat is indicated.
   2. Products:
      a. Custom Building Products; MegaLite: www.custombuildingproducts.com.
      b. Merkrete, by Parex USA, Inc; Merkrete 735 Premium Flex: www.merkrete.com/sle.
      c. LATICRETE International, Inc.; LATICRETE 254 Platinum: www.laticrete.com.
      d. ProSpec, and Oldcastle brand; Permalastic System: www.prospec.com.
      e. Mapei; Ultraflex 3: www.mapei.com
      f. Substitutions: See Section 01 60 00 - Product Requirements.

B. Improved Latex-Portland Cement Mortar Bond Coat: ANSI A118.15.
   1. Applications: Tile over existing tile or epoxy floor.
   2. Products:
      a. Custom Building Products; ProLite Premium Large Format Tile Mortar, with Multi-Surface Bonding Primer: www.custombuildingproducts.com.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 GROUTS

A. Polymer Modified Grout: ANSI A118.7 polymer modified cement grout.
   1. Applications: Use this type of grout where indicated and where no other type of grout is indicated.
   2. Use sanded grout for joints 1/8 inch wide and larger; use unsanded grout for joints less than 1/8 inch wide.
   3. Color(s): As selected by Architect from manufacturer's full line.
   4. Products:
      a. Custom Building Products; Prism Color Consistent Grout: www.custombuildingproducts.com.
      b. Mapei; Ultracolor plus: www.mapei.com

2.05 MAINTENANCE MATERIALS

A. Tile Sealant: 100% Silicone caulk complyingwith ASTM C920, Class 25, moisture and mildew resistant type.
   1. Applications: Between tile and plumbing fixtures.
   2. Color(s): As selected by Architect from manufacturer's full line.
   3. Products:
      a. Custom Building Products; Commercial 100% Silicone Caulk: www.custombuildingproducts.com.
      b. Approved equal product.

B. Grout Sealant: Manufacturer's standard product for sealing grout joints that does not change color or appearance of grout.
   1. Products:
      a. Bonsal, W.R., Company; Grout Sealater
      b. Bostik; CeramaSeal Grout Sealer.
      c. C-Cure; Penetrating Sealer 978.
      d. Mapei Corporation: KER 003, Silicone Spray Sealer for Cementitious Tile Grout
      e. Summitville Tiles, Inc.; SL-15, Invisible Seal Penetrating Grout and Tile Sealer.
      f. TEC Specialty Products Inc.; TA-256 Penetrating Silicone Grout Sealer.
      g. Aqua Mix; Sealers Choice Gold.

2.06 ACCESSORY MATERIALS

A. Single-component, water-based primer specially formulated with aggregates and polymers to promote mechanical adhesion on non-porous substrates.
   1. Applications: Tile over existing tile or epoxy floor.
   2. Products:
      a. Custom Building Products; MBP Multi Surface Primer

B. Premium Latex Based Waterproofing and Crack Isolation Membrane; fast setting, flexible, thin, load-bearing, waterproofing membrane system consisting of a premixed, quick-drying liquid latex, complying with ANSI A118.10 and ANSI A118.12; and having IAMPO certification as a shower pan liner.
   1. Products:
      a. MAPEI, "AquaDefense".
      b. Custom Building Products; Red Gard.

C. Premixed, liquid-rubber, quick-drying crack-isolation membrane for installation under ceramic tile or stone complying with ANSI A118.12;

1. Products:
    a. MAPEI, "Mapelastic CI".
    b. Custom Building Products; Fracture Free.

D. Concentrated, high-alkaline cleaner and degreaser. Removes grease, soap scum, synthetic and acrylic waxes, floor finishes, and other organic materials from areas that have been neglected or subjected to heavy use.
1. Application: Tile over existing tile or epoxy floor.
2. Products:
    a. Custom Building Prodcuts; Aqua Mix Heavy Duty Tile & Grout Cleaner.
    b. MAPEI; UtlraCare Heavy Duty Stone, Tile & Grout Cleaner.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.

C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of setting materials to sub-floor surfaces.

D. Verify that concrete sub-floor surfaces are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within limits recommended by tile manufacturer and setting materials manufacturer.

E. Verify that required floor-mounted utilities are in correct location.

3.02 PREPARATION

A. Protect surrounding work from damage.

B. Vacuum clean surfaces and damp clean.

C. Seal substrate surface cracks with filler.

3.03 INSTALLATION - GENERAL

A. Install tile and thresholds and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.13, manufacturer's instructions, and TCNA (HB) recommendations.

B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.

C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.

D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.

E. Form internal angles square and external angles bullnosed.

F. Install non-ceramic trim in accordance with manufacturer's instructions.

G. Sound tile after setting. Replace hollow sounding units.

H. Keep control and expansion joints free of mortar, grout, and adhesive.

I. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

J. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.

K. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

L. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

3.04 INSTALLATION - FLOORS - THIN-SET METHODS

A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F125-Full, with Latex/Polymer Modified Portland Cement Mortar and Polymer Modified Tile, with standard grout, unless otherwise indicated.

1. Use uncoupling membrane under all tile unless other underlayment is indicated.
2. Where waterproofing membrane is indicated, install in accordance with TCNA (HB) Method F122, with latex-Portland cement grout.
   a. Locations: Toilet rooms with floor drains.

3.05 INSTALLATION - FLOORS - TILE OVER EXISTING TILE OR EPOXY FLOOR

A. Over existing tile or resinous flooring substrate, clean, prepare, and install in accordance with TCNA (HB) Method TCNA TR711-18 and TR712-18.

B. Waterproofing Membrane: Install over multi surface primer, and as recommended by manufacturer.

3.06 INSTALLATION - FLOORS –SELF LEVELING

A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F205A , unless otherwise indicated.

B. Waterproofing Membrane: Install as recommended by manufacturer and as specified in the section in which the product is specified.

3.07 INSTALLATION - WALL TILE

A. Over cementitious backer units on studs, install in accordance with TCNA (HB) Method W244, using membrane at toilet rooms.

B. Over interior concrete and masonry install in accordance with TCNA (HB) Method W202, thin-set with dry-set or latex-Portland cement bond coat.

3.08 GROUTING

A. Follow grout manufacturer's recommendations as to grouting procedures and precautions.

B. Remove all grout haze, observing both tile and grout manufacturer's recommendations as to use of acid and chemical cleaners.

C. Rinse tile work thoroughly with clean water before and after chemical cleaners.

D. Polish surface of tile work with soft cloth.

3.09 PROTECTION, CLEANING AND GROUT SEALING

A. Do not permit traffic over finished floor surface for 4 days after installation.

B. Apply to clean, completed tile walls and floors a protective coat of neutral cleaner solution, 1 part cleaner to 1 part water.

C. Cover tile floors with heavy-duty, non-staining construction paper, masked in place.

D. Prior to final acceptance of tile work, remove paper and rinse protective coat of neutral cleaner from all the surfaces.

E. Clean tile and grout surfaces.

F. Apply grout sealant according to manufacturer's directions.

END OF SECTION

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SECTION 09 51 00
ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

C. Accessories

1.02 RELATED REQUIREMENTS

A. Section 01 74 19 – Construction Waste Management.

B. Section 01 81 13 – Sustainable Design Requirements.

C. Section 01 81 19 – Indoor Air Quality Requirements.

D. Section 21 13 00 - Fire-Suppression Sprinkler Systems: Sprinkler heads in ceiling system.

E. Section 23 37 00 - Air Outlets and Inlets: Air diffusion devices in ceiling.

F. Section 26 51 00 - Interior Lighting: Light fixtures in ceiling system.

G. Section 27 51 16 - Public Address Systems: Speakers in ceiling system.

1.03 REFERENCE STANDARDS

A. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2013a.

B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2013.

C. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2016.

D. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2014.

1.04 LEED REQUIREMENTS

A. LEED Focus Materials (LFMs) For This Section:
   1. Targeted products containing Recycled Content (MRc4)
   2. Targeted products containing Regional Material (MRc5)

1.05 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Product Data: Provide data on suspension system components, acoustical units, and other related components.

C. Samples: Submit two samples 12 by 12 inch in size illustrating material and finish of acoustical units.

D. Manufacturer's Installation Instructions: Indicate special procedures.

E. LEED Product and Material Data Summary Form: For all installed products and materials of this Section, complete the “LEED Product and Material Data Summary Form” (attached to end of Section 01 81 13 - Sustainable Design Requirements)

1. Product Material Cost: Provide the cost for material, or an assembled product, including taxes and delivery but excluding any cost for labor and equipment required for installation after the material is delivered to the site.
2. Product Data for Credit MRc4, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating cost for each product having recycled content.
3. Product Data for Credit MRc5, Regional Material: For products having regional materials, documentation indicating location of raw material extraction, harvest or recovery, as well as, manufacture (location of final assembly) within 500 miles of project site. Include statement indicating cost for each material or component of the assembled product.

1.06 QUALITY ASSURANCE

A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Sustainability and LEED Standards Certification:
   1. Regional manufactured products with percentage by weight.
   2. Recycled content calculated as 1/2 preconsumer + postconsumer.
   3. VOC content limitations defined in Section 018114, "Volatile Organic Compound (VOC) Limits For Adhesives, Sealants, Paints, and Coatings."

1.07 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.01 ACOUSTIC CEILING PANEL SCHEDULE:

Ceiling Type	Description	Grid Type
ACT-1	High NRC, mold-mildew protection	Type 1
ACT-2	Durable, High NRC, mold-mildew protection	Type 2
ACT-3	Approved for Kitchens, Food Prep, Clean Rooms	Type 2

2.02 MANUFACTURERS

A. Acoustic Tiles/Panels:
   1. Armstrong World Industries, Inc: www.armstrong.com.
   2. CertainTeed Corporation: www.certainteed.com.
   3. USG: www.usg.com.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Suspension Systems:
   1. Same as for acoustical units.

2.03 ACOUSTICAL UNITS

A. Acoustical Units - General: ASTM E1264, Class A.

B. Acoustical Panels Type ACT-1: Painted mineral fiber, ASTM E1264 Type III, with the following characteristics:
   1. Size: 24 by 24 inches.
   2. Thickness: 3/4 inches.
   3. Composition: Wet formed.
   4. NRC Range: 0.70 to 0.75, determined as specified in ASTM E 1264.
   5. Ceiling Attenuation Class (CAC): 35, determined in accordance with ASTM E1264.
   6. Edge: Square.
   7. Surface Color: White.
   8. Products:
      a. Armstrong Fine Fissured High NRC 1754
      b. USG - Radar ClimaPlus High NRC/CAC Item No. 22111
   9. Suspension System: Exposed grid Type 1.
   10. Location: Classrooms and Offices- typical, unless otherwise noted

C. Acoustical Panels Type ACT-2: Painted mineral fiber, ASTM E 1264 Type 1 with the following characteristics:
   1. Size: 24 by 24 inches.
   2. Thickness: 5/8 inches.
   3. Composition: Wet formed.
   4. NRC Range: .50 to .60, determined as specified in ASTM E1264.
   5. Ceiling Attenuation Class (CAC): 38, determined as specified in ASTM E1264.
   6. Edge: Square.
   7. Surface Color: White.
   8. Surface Pattern: fine texture.
   9. Product:
      a. Armstrong Dune 1772.
      b. USG Olympia 4211.
   10. Suspension System: Exposed grid Type 2 .
   11. Location: Student corridors, Toilet Rooms, other areas as noted.

D. Acoustical Panels Type ACT-3: Painted mineral fiber, ASTM E 1264 Type 1 with the following characteristics:
   1. Size: 24 by 24 inches.
   2. Thickness: 7/8 inches.
   3. Composition: Wet formed.
   4. NRC Range: .80 to .85, determined as specified in ASTM E1264.
   5. Ceiling Attenuation Class (CAC): 35, determined as specified in ASTM E1264.
   6. Edge: Square.
   7. Surface Color: White.
   8. Surface Pattern: fine texture.
   9. Product:
      a. Armstrong : Health Zone Ultima High NRC, Item No 1445.
      b. USG: Mars ClimaPlus Healthcare, Item No. 86152.
   10. Suspension System: Exposed grid Type 2 .
   11. Location: Kitchen, Servery, other areas as noted.

2.04 SUSPENSION SYSTEM(S)

A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required.

B. Exposed Steel Suspension System Type 1: Formed galvanized steel, commercial quality cold rolled; intermediate-duty.
   1. Profile: Tee; 15/16 inch wide face.
   2. Construction: Double web.
   3. Finish: White painted.
   4. Products:
      a. Prelude XL by Armstrong.
      b. DX by USG.

C. Exposed Steel Suspension System Type 2: Where this designation is indicated, provide acoustical panel ceiling suspension system complying with the following:
   1. Products:
      a. ZXLA; USG
      b. Prelude Plus; Armstrong
   2. Wide-Face, Capped, Double-Web, Hot-Dip Galvanized-Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet hot-dip galvanized according to ASTM A 653/A 653M, G60 (Z180) coating designation, with pre-finished, 15/16-inch-(24-mm-) wide, aluminum caps on flanges; other characteristics as follows:
      a. Aluminum Cap Finish: Painted white.

D. Perimeter Trim:
   1. Products:
      a. Borders at Corridor ACT: Armstrong Axiom Classic Trim, 3-13/16" (nominal 4") high, extruded aluminum, curved & Straight applications.
   2. Finish: as selected from manufacturer's standard range.

2.05 ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

B. Perimeter Moldings: Same material and finish as grid.
   1. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid.

C. Acoustical Insulation: Specified in Section 07 21 00.

D. Acoustical Sealant For Perimeter Moldings: Non-hardening, non-skinning, for use in conjunction with suspended ceiling system.
   1. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard non-sag, paintable, non-staining latex sealant complying with ASTM C 834 and the following requirements:
      a. Product is effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
   2. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
      a. Acoustical Sealant for Exposed and Concealed Joints:

1) PL Acoustical Sealant; Chemrex, Inc., Contech Brands.
2) AC-20 FTR Acoustical and Insulation Sealant; Pecora Corp.
3) SHEETROCK Acoustical Sealant; United States Gypsum Co.

E. Gasket For Perimeter Moldings: Closed cell rubber sponge tape.

F. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

3.02 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.

B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

C. Locate system on room axis according to reflected plan.

D. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.

E. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

F. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

H. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.

I. Do not eccentrically load system or induce rotation of runners.

J. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
   1. Install with continuous gasket.
   2. Use longest practical lengths.
   3. Miter corners.

K. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
   1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
   2. Screw attach moldings to substrate at intervals not more than 16 inches (400 mm) o.c. and not more than 3 inches (75 mm) from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet (3 mm in 3.6 m). Miter corners accurately and connect securely.
   3. Do not use exposed fasteners, including pop rivets, on moldings and trim.

L. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, counter splaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure; that are appropriate for substrate; and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, powder-actuated fasteners, or drilled-in anchors that extend through forms into concrete.
6. Do not attach hangers to steel deck tabs.
7. Do not attach hangers to steel roof deck. Attach hangers to structural members.
8. Space hangers not more than 48 inches (1200 mm) o.c. along each member supported directly from hangers, unless otherwise indicated; and provide hangers not more than 8 inches (200 mm) from ends of each member.

M. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

N. Install special brake-metal shapes at window heads so that they are square and finished to provide a precise fit. Do not use exposed fasteners.

O. Install acoustical panels with undamaged edges and fitted accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
1. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
2. For reveal-edged panels on suspension system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
3. Paint cut panel edges remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
4. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions, unless otherwise indicated or required.

3.03 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Fit border trim neatly against abutting surfaces.

D. Install units after above-ceiling work is complete.

E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

F. Cutting Acoustical Units:
   1. Cut to fit irregular grid and perimeter edge trim.
   2. Make field cut edges of same profile as factory edges.
   3. Double cut and field paint exposed reveal edges.

G. Where round obstructions, bullnose concrete block corners, and other similar conditions occur, provide preformed closures to match perimeter molding.

H. Lay acoustical insulation for a distance of 48 inches either side of acoustical partitions as indicated.

3.04 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION

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SECTION 09 52 00
SPECIALTY CEILING SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Linear Acoustic Panels

1.02 REFERENCE STANDARDS

A. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method; 2009a.

B. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2013a.

C. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2013.

1.03 LEED REQUIREMENTS

A. LEED Focus Materials (LFMs) For This Section:
   1. Targeted products containing Recycled Content (MRc4)
   2. Targeted products containing Regional Material (MRc5)

1.04 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

C. Samples: Minimum 6 inch x 6 inch samples of specified acoustical panel; 8 inch long samples of exposed wall molding and suspension system, including main runner and 4 foot cross tees.

D. Samples: Minimum 2 inch x 3 inch samples of specified canopy.

E. Shop Drawings: Layout and details of acoustical ceilings show locations of items that are to be coordinated with, or supported by the ceilings.

F. Shop Drawings: Layout and details of canopies. Show locations of items which are to be coordinated with canopies.

G. Acoustical Certifications - Linear Acoustic Panels: Manufacturer's certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards. For acoustical performance, each carton of material must carry an approved independent laboratory classification of NRC, CAC, and AC.
   1. If the material supplied by the acoustical subcontractor does not have an Underwriter's Laboratory classification of acoustical performance on every carton, subcontractor shall be required to send material from every production run appearing on the job to an independent or NVLAP approved laboratory for testing, at the architect's or owner's discretion. All products not conforming to manufacturer's current published values must be removed, disposed of and replaced with complying product at the expense of the Contractor performing the work.

H. Certifications - Translucent Suspended Canopies: Manufacturer's certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards.

I. LEED Product and Material Data Summary Form: For all installed products and materials of this Section, complete the "LEED Product and Material Data Summary Form" (attached to end of Section 01 81 13 - Sustainable Design Requirements)
   1. Product Material Cost: Provide the cost for material, or an assembled product, including taxes and delivery but excluding any cost for labor and equipment required for installation after the material is delivered to the site.
   2. Product Data for Credit MRc4, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating cost for each product having recycled content.
   3. Product Data for Credit MRc5, Regional Material: For products having regional materials, documentation indicating location of raw material extraction, harvest or recovery, as well as, manufacture (location of final assembly) within 500 miles of project site. Include statement indicating cost for each material or component of the assembled product.

1.05 QUALITY ASSURANCE

A. Single-Source Responsibility:
   1. Provide acoustical panel units and grid components by a single manufacturer.
   2. Provide canopies and method of attachment by a single manufacturer.

B. Coordination of Work: Coordinate canopy work with installers of related work including, but not limited to suspended ceilings, building insulation, gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in manufacturer's unopened packaging and store unopened in fully enclosed space until ready for installation. Protect products from exposure to sunlight, moisture, and mechanical damage.

B. Handle acoustical panels and canopies carefully to avoid soiling exposed surfaces or damaging surfaces and edges.

C. Before installing materials, permit them to reach room temperature and a stabilized moisture content.

1.07 FIELD CONDITIONS

A. Maintain temperature within 15 degrees Fahrenheit and relative humidity within 10 percent of design conditions for spaces of installation not less than 48 hours before installation begins and thereafter.

1.08 WARRANTY

A. See Section 01 77 00 - Closeout Procedures, for additional warranty requirements.

B. Acoustical Panel: Submit a written warranty executed by the manufacturer, agreeing to repair or replace panels that fail within the warranty period. Failures include, but are not limited to the following:
   1. Acoustical Panels: Sagging and warping
   2. Grid System: Rusting and manufacturer's defects

C. Acoustical Panel Warranty Period:
   1. Acoustical panels: Ten (10) years from date of substantial completion
   2. Suspension: Ten (10) years from date of substantial completion
   3. Ceiling System: Thirty (30) years from date of substantial completion

D. Canopy Products: Submit a written warranty executed by the manufacturer, agreeing to repair or replace canopies that fail within the warranty period. Failures include, but are not limited to:
   1. Canopy: Manufacturer's defects.
   2. Attachment devices: Rusting and manufacturer's defects.

E. Canopy Products Warranty Period:
   1. Canopy Products: One (1) year from date of substantial completion.
   2. Attachment devices: One (1) year from date of substantial completion.

F. The Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

PART 2 PRODUCTS

2.01 LINEAR ACOUSTIC PANELS

A. Manufacturers
   1. Basis of Design:
      a. Armstrong World Industries, Inc.; Soundscapes Blades.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

B. Soundscapes Blades: Suspended Linear Acoustic Ceiling Baffle
   1. Surface Texture: Fine
   2. Composition: Fiberglass
   3. Colors: White (WH), Stone (SE), Plum (PM), Kiwi (KW)
   4. Sizes: 22 inches by 46 inches, 22 inches by 94 inches
   5. Thickness: 2 inches
   6. Sabin:1.38
   7. Flame Spread: ASTM E 1264; Class A (UL)
   8. Suspension System: Independently suspended four-point hanging system
   9. Locations: 1st Floor and 2nd Floor Learning Commons

2.02 SUSPENDED ACOUSTIC CEILING ANGLES

A. Manufacturers
   1. Basis of Design:
      a. Arktura; SoundAngle: www.arktura.com

B. SoundAngle: v-shaped acoustic ceiling baffles
   1. Material: Softsound acoustical material, 100% PET plastic with up to 60% recycled content
   2. Fire Rating: ASTM E84 Class A
   3. Sound Absorption: ASTM C423-90A
   4. Sizes: As indicated on drawings
   5. Thickness: 1/2" panels

6. Color: To be selected from manufacturers full range
7. Suspension System: Stainless steel cable, and adjustable quick connect fastener.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that layout of hangers will not interfere with other work; make adjustments in layout as necessary.

B. Coordinate ceiling installation with other trades.

C. Notify Architect of unsatisfactory conditions before proceeding.

3.02 PREPARATION

A. Measure each ceiling area and establish layout of canopies. Comply with reflected ceiling plans. Coordinate panel layout with mechanical, electrical and sprinkler fixtures.

3.03 INSTALLATION OF LINEAR ACOUSTIC PANELS

A. Follow manufacturer installation instructions.

B. Install suspension system and panels in accordance with the manufacturer's instructions, and in compliance with ASTM C 636 and with the authorities having jurisdiction.

3.04 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including suspension system and edge trim, complying with manufacturer's written instructions for cleaning of minor finish damage. Replace acoustical panels that cannot be cleaned to an appearance matching unmarred panels.

B. Clean exposed surfaces of canopies per installation instructions.

END OF SECTION

SECTION 09 54 23
LINEAR METAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Linear metal ceilings.

B. Suspended metal support system and perimeter trim.

1.02 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

B. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

C. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.

D. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2013.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.

F. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2016.

1.03 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Product Data: Furnish for component profiles.

C. Shop Drawings: Indicate reflected ceiling plan.

D. Samples: Submit two samples 6 by 6 inch in size illustrating color and finish of exposed to view components.

1.04 QUALITY ASSURANCE

A. Designer Qualifications for Seismic Design: Under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed at the State in which the Project is located.

B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept factory-finished products on site in manufacturer's unopened factory packaging only; reject opened packages.

B. Protect factory-finished products from damage to appearance by storing products in manufacturer's unopened factory packaging in dry storage area.

1.06 WARRANTY

A. See Section 01 77 00 - Closeout Procedures, for additional warranty requirements.

B. Provide five year manufacturer warranty; include coverage for corrosion resistance and discoloration of surface finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design
   1. Hunter Douglas Architectural; 150F Linear Metal Soffit System: www.hunterdouglasarchitectural.com

B. Acceptable Manufacturers:
   1. ATAS International, Inc: www.atas.com/#sle.
   2. USG: www.usg.com.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 LINEAR METAL CEILINGS

A. Linear Metal Ceiling System: Panels, suspension members, trim, and accessories as required to provide a complete system.

B. Performance Requirements:
   1. Design to support imposed loads of indicated items without eccentric loading of supports.
   2. Design for maximum deflection of 1/360 of span.
   3. Systems Located Outside Building Envelope:
      a. Accommodate wind and suction loads and wind uplift without damage in accordance with applicable code.

2.03 COMPONENTS

A. Linear Metal Panels:
   1. Type: Torsion spring panel; downward accessible flat panels.
   2. Material: Aluminum sheet, ASTM B209 (ASTM B209M).
      a. Finish: Custom Color

B. Edge Molding, Expansion Joints, and Splices: Same material, thickness, and finish as linear panels.

C. End Caps: Formed metal; same color and finish as sight-exposed surfaces of linear panels.

D. Accessories: Stabilizer bars as required for suspended grid system; sight-exposed surfaces same color and finish as sight-exposed surfaces of linear panels.

E. Suspension Wire: Size and type as required for application and ceiling system flatness requirement specified.

F. Subgirt Members: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating; formed to resist imposed loads and to provide attachment for linear ceiling and accessories.

2.04 FABRICATION

A. Factory-form internal and external corners of same material, thickness, finish, and profile to match exposed linear panels; back brace internal corners.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

C. Verify that required utilities are available, in proper location, and ready for use.

D. Verify that field measurements are as indicated.

3.02 INSTALLATION

A. Suspension Components:
   1. Install after above-ceiling work is complete in accordance with manufacturer's instructions, ASTM C636/C636M, and ASTM E580/E580M.
   2. Hang carrying members independent of walls, columns, ducts, light fixtures, pipe, and conduit; where carrying members are spliced, avoid visible displacement of face panels with adjacent panels.
   3. Where ducts or other equipment prevent regular spacing of hangers, reinforce nearest adjacent hangers to span the required distance.

B. Linear Metal Ceiling:
   1. Install linear panels and other system components in accordance with manufacturer's instructions.
   2. Stagger end joints minimum 12 inches.
   3. Field miter corners at changes in panel direction.
   4. Exercise care when site cutting sight-exposed finished components to ensure surface finish is not defaced.

3.03 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

3.04 CLEANING

A. Replace damaged or abraded components.

END OF SECTION

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SECTION 09 65 00
RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Resilient sheet flooring.

B. Resilient tile flooring.

C. Resilient base.

D. Resilient stair accessories.

E. Installation accessories.

1.02 RELATED REQUIREMENTS

A. Section 01 74 19 – Construction Waste Management.

B. Section 01 81 13 – Sustainable Design Requirements.

C. Section 01 81 19 – Indoor Air Quality Requirements.

D. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.

E. Section 09 05 61 - Common Work Results for Flooring Preparation: Independent agency testing of concrete slabs, removal of existing floor coverings, cleaning, and preparation.

1.03 REFERENCE STANDARDS

A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2015.

B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2011.

C. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile; 2004 (Reapproved 2014).

D. ASTM F1344 - Standard Specification for Rubber Floor Tile; 2015.

E. ASTM F1861 - Standard Specification for Resilient Wall Base; 2008 (Reapproved 2012).

F. ASTM F1913 - Standard Specification for Vinyl Sheet Floor Covering Without Backing; 2004 (Reapproved 2014).

G. ASTM F2169 - Standard Specification for Resilient Stair Treads; 2015.

H. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2015.

1.04 LEED REQUIREMENTS

A. LEED Focus Materials (LFMs) For This Section:

1. Targeted products containing Recycled Content (MRc4)
2. Targeted products containing Regional Material (MRc5)
3. Targeted products to meet VOC requirements (EQc4.1 & EQc4.2)
4. Targeted products to meet Low Emitting Flooring requirements (EQc4.3)

1.05 SUBMITTALS

A. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

B. Shop Drawings: Indicate seaming plans and floor patterns.

C. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.

D. Verification Samples: Submit two samples, 6 by 6 inch in size illustrating color and pattern for each resilient flooring product specified.

E. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of sub-floor is acceptable.

F. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. Extra Flooring Material: 100 square feet of each type and color.
   2. Extra Wall Base: 50 linear feet of each type and color.
   3. Extra Stair Materials: Quantity equivalent to 5 percent of each type and color.

H. LEED Product and Material Data Summary Form: For all installed products and materials of this Section, complete the “LEED Product and Material Data Summary Form” (attached to end of Section 01 81 13 - Sustainable Design Requirements)
   1. Product Material Cost: Provide the cost for material, or an assembled product, including taxes and delivery but excluding any cost for labor and equipment required for installation after the material is delivered to the site.
   2. Product Data for Credit MRc4, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating cost for each product having recycled content.
   3. Product Data for Credit MRc5, Regional Material: For products having regional materials, documentation indicating location of raw material extraction, harvest or recovery, as well as, manufacture (location of final assembly) within 500 miles of project site. Include statement indicating cost for each material or component of the assembled product.
   4. Product Data for Credit EQc4.1, Adhesives & Sealants: For adhesives and sealants, documentation including printed statement of VOC content and chemical components.
   5. Product Data for Credit EQc4.3, Flooring: Certificates from product manufacturer or testing agency for flooring products indicating that they comply with the applicable standards.

1.06 QUALITY ASSURANCE

A. Sustainability and LEED Standards Certification:
   1. Regional manufactured products with percentage by weight.
   2. Recycled content calculated as 1/2 preconsumer + postconsumer.
   3. VOC content limitations defined in Section 018114, "Volatile Organic Compound (VOC) Limits For Adhesives, Sealants, Paints, and Coatings."

1.07 DELIVERY, STORAGE, AND HANDLING

A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.

B. Store all materials off of the floor in an acclimatized, weather-tight space.

C. Maintain temperature in storage area between 55 degrees F and 90 degrees F.

D. Protect roll materials from damage by storing on end.

E. Do not double stack pallets.

1.08 FIELD CONDITIONS

A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

PART 2 PRODUCTS

2.01 TILE FLOORING

A. Vinyl Composition Tile: Type VCT-1, VCT-2, VCT-3 Homogeneous, with color extending throughout thickness.
   1. Manufacturers:
      a. Armstrong World Industries, Inc; Product Excelon Imperial Texture: www.armstrong.com.
      b. Mannington Mills, Inc; Product Essentials: www.mannington.com.
      c. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Minimum Requirements: Comply with ASTM F1066, of Class corresponding to type specified.
   3. Size: 12 by 12 inch.
   4. VOC Content Limits: As specified in Section 01 61 16.
   5. Thickness: 0.125 inch.
   6. Pattern: As indicated on drawings.
   7. Color: As indicated on drawings.

B. Rubber Tile: Type RT-1, RT-2, RT-3, RT-4, RT-5, RT-6 Type I- Homogeneous, color and pattern throughout thickness;
   1. Manufacturers:
      a. Basis of Design: Nora Systems, Inc.; noraplan sentica: www.nora.com
      b. Johnsonite, a Tarkett Company; Mesto Configurations: www.johnsonite.com.
      c. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Minimum Requirements: Comply with ASTM F1344, of Class corresponding to type specified.
   3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
   4. VOC Content Limits: As specified in Section 01 61 16.
   5. Size: 24 by 24 inch.
   6. Total Thickness: 0.125 inch (3.0 mm).
   7. Pattern: As indicated on drawings.
   8. Color: As indicated on drawings.

9. Surface:
   a. Nora: Smooth
   b. Johnsonite: Hammered
10. Hardness: ASTM D2240, Shore type "A", greater than or equal to 85 is required.
11. Limited Wear Warranty: 10 years
12. Slip Resistance: ASTM D2047 Static coefficient of friction, Neolite dry 0.93, Neolite wet 0.91 achieved, greater than or equal to 0.5 is required.
13. Flammability: ASTM E648; NFPA 253; NBSIR 75 950, greater than or equal to 0.45 watts/sq cm for class 1 is required.
14. Smoke Density: ASTM E662; NFPA 258:less than 450 is required

2.02 STAIR COVERING

A. Stair Treads (RST-1): Rubber; full width and depth of stair tread in one piece; tapered thickness.
   1. Manufacturers:
      a. Basis of Design: Johnsonite, a Tarkett Company: www.johnsonite.com
      b. Burke Flooring: www.burkeflooring.com.
      c. Roppe Corp: www.roppe.com.
      d. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Minimum Requirements: Comply with ASTM F2169, Type TS, rubber, vulcanized thermoset.
   3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
   4. Thickness: 0.210 inches, tapering to 0.113 inches.
   5. Nosing: Tapered.
   6. Striping: 2 inch wide contrasting color rubber strips.
   7. Pattern: Johnsonite "Bamboo" surface texture, or equivalent texture from other listed manufacturers..
   8. Color: As indicated on drawings.

2.03 RESILIENT BASE

A. Resilient Base Type RB-1, RB-2: ASTM F1861, Type TS rubber, vulcanized thermoset; top set Style B, Cove.
   1. Manufacturers:
      a. Basis of Design: Roppe Corp: www.roppe.com.
      b. Johnsonite, a Tarkett Company: www.johnsonite.com.
      c. Substitutions: See Section 01 60 00 - Product Requirements.
   2. Height: 4 inch (typical, unless otherwise noted).
   3. Thickness: 0.125 inch.
   4. Finish: Satin.
   5. Color: As indicated on drawings.

2.04 REMEDIAL FLOOR COATING

A. Manufacturer
   1. Schönox, HPS North America, Inc.; 511 Wilhite Street, Florence, AL 35630; Phone: (855) 391-2649, (256) 246-0345; Fax: (256) 246-0346; Email: info@hpsubfloors.com; Website: www.hpsubfloors.com

B. Application: All slab on grade locations and second floor slab that are scheduled to receive resilient flooring.

C. Remedial Floor Coating: Single- or multi-layer coating or coating/overlay combination intended by its manufacturer to resist water vapor transmission to degree sufficient to meet flooring manufacturer's emission limits, resistant to the level of alkalinity (pH) found, and suitable for adhesion of flooring without further treatment.
   1. Primer: Schonox EPA Two-part Epoxy-based moisture mitigation system.
      a. Drying time: 4 to 6 hours at 65 degrees F.
      b. Color: Transparent amber.
      c. VOC content: 0
   2. Self-Leveling Underlayment: Schonox AP Self-leveling compound
      a. Compressive Strength: To ASTM C109, 5800psi at 28 days.
      b. Flexural Strength: To ASTM C348, 1400psi at 28 days.
      c. Tensile Strength: To ASTM C1583, 400 psi after 3 days.
      d. Initial Set: approximately 160 minutes at 70 degrees F.
      e. Final Set: approximately 200 minutes at 70 degrees F.
      f. Foot-traffic Ready: 2 hours minimum
      g. Fire Burning Characteristics to ASTM E84:
         1) Flame spread: 0.
         2) Smoke developed: 0.
      h. VOC: 0 g/l to SCAQMD Rule 1113.

2.05 ACCESSORIES

A. Moldings, Transition and Edge Strips: Same material as flooring.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.

C. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for resilient flooring installation by testing for moisture and pH.
   1. Test in accordance with Section 09 05 61.
   2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

3.02 PREPARATION

A. Prepare floor substrates for installation of flooring in accordance with Section 09 05 61.

3.03 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of sub-floor conditions.

B. Install in accordance with manufacturer's written instructions.

C. Spread only enough adhesive to permit installation of materials before initial set.

D. Fit joints and butt seams tightly.

E. Set flooring in place, press with heavy roller to attain full adhesion.

F. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.

G. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.

H. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

I. Install flooring in recessed floor access covers and expansion joint covers, maintaining floor pattern.

J. At movable partitions, install flooring under partitions without interrupting floor pattern.

3.04 INSTALLATION - TILE FLOORING

A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.

B. Lay flooring with joints and seams parallel to building lines to produce symmetrical pattern.

3.05 INSTALLATION - RESILIENT BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.

B. Miter or scribe internal corners. At external corners, 'V' cut back of base strip to 2/3 of its thickness and fold. At exposed ends, use premolded units.

C. Install base on solid backing. Bond tightly to wall and floor surfaces.

3.06 INSTALLATION - STAIR COVERINGS

A. Adhere over entire surface. Fit accurately and securely.

3.07 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's written instructions.

END OF SECTION

SECTION 09 66 16
PRECAST CEMENT TERRAZZO TREADS AND LANDINGS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Precast Terrazzo Treads and Landings

B. Setting material, grouts, sealants and caulks

C. Installation of precast terrazzo stairs, base, sills, etc.

1.02 RELATED SECTIONS

A. Section 01 74 19 – Construction Waste Management.

B. Section 01 81 13 – Sustainable Design Requirements.

C. Section 01 81 14 – Volatile Organic Compound (VOC) Limits For Adhesives, Sealants, Paints & Coatings.

D. Section 01 81 19 – Indoor Air Quality Requirements.

E. Section 05 5100: Installation of steel stairs to receive precast terrazzo.

1.03 REFERENCES

A. American Society for Testing and Materials (ASTM)

B. ASTM C-150

C. ASTM C-33

D. ASTM C-140

E. ASTM C-293

F. ASTM C-1028

G. National Terrazzo and Mosaic Association Inc. (NTMA)

H. Federal Register Part III 28 CFR Part 36

1.04 LEED REQUIREMENTS:

A. LEED Focus Materials (LFMs) For This Section:
   1. Targeted products containing Recycled Content (MRc4)
   2. Targeted products containing Regional Material (MRc5)
   3. Targeted products to meet Low Emitting Flooring requirements (EQc4.3)

1.05 SUBMITTALS

A. Submit in accordance with provisions of Section 00 13 00.

B. Shop Drawings
   1. Submit shop drawings of all precast terrazzo items showing detailed sections and profile for all precast items. Details shall show all reinforcing and special hardware for fastening.

C. Samples:
   1. Submit samples, 6" x 6" size, for all colors.

D. Submit two copies of NTMA maintenance literature.

E. LEED Product and Material Data Summary Form: For all installed products and materials of this Section, complete the "LEED Product and Material Data Summary Form" (attached to end of Section 01 81 13 - Sustainable Design Requirements)
   1. Product Material Cost: Provide the cost for material, or an assembled product, including taxes and delivery but excluding any cost for labor and equipment required for installation after the material is delivered to the site.
   2. Product Data for Credit MRc4, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating cost for each product having recycled content.
   3. Product Data for Credit MRc5, Regional Material: For products having regional materials, documentation indicating location of raw material extraction, harvest or recovery, as well as, manufacture (location of final assembly) within 500 miles of project site. Include statement indicating cost for each material or component of the assembled product.
   4. Product Data for Credit EQc4.3, Flooring: Certificates from product manufacturer or testing agency for flooring products indicating that they comply with the applicable standards.

1.06 PERFORMANCE REQUIREMENTS:

A. Compressive Strength 4000 p.s.i.

B. Flexural Strength 600 p.s.i.

C. Certification: Suppliers shall furnish certification attesting that materials meet specification requirements.

1.07 QUALITY ASSURANCE

A. NTMA Standards: Comply with specified provisions and recommendations of the National Terrazzo & Mosaic Association, Inc. (NTMA).

B. Manufacturer's Instructions: In addition to specified requirements, comply with precast terrazzo manufacturer's instructions and recommendations for substrate preparation, materials storage, mixing and application, finishing and curing.

C. Qualifications: Precast Terrazzo Manufacturer and Trade Contractor must have a minimum of 5 years of successful experience on projects of similar magnitude and complexity to that indicated project.

D. Sustainability and LEED Standards Certification:
   1. Regional manufactured products with percentage by weight.
   2. Recycled content calculated as 1/2 preconsumer + postconsumer.
   3. VOC content limitations defined in Section 018114, "Volatile Organic Compound (VOC) Limits For Adhesives, Sealants, Paints, and Coatings."
   4. Low Emitting Flooring certification.

1.08 DELIVERY, STORAGE AND HANDLING

A. Packaging and Shipping: Precast terrazzo to be palletized and shrink wrapped, delivered in original unopened packaging.

B. Storage and Protection: Precast terrazzo to be stored indoors, sheltered from moisture in original packaging. Protect from damage by other trades.

1.09 WARRANTY

A. Manufacturer/Installer shall warrant installed system for a period of 1 year from date of substantial completion against failure of workmanship and materials.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design:
   1. Wausau Tile, Inc.

B. Substitutions will be considered under the provisions of Section 00 1600.
   1. Other manufacturer's shall comply with minimum levels of material specifications and detailing indicated on the drawings of specified herein.

2.02 MATERIALS

A. Portland Cement: ASTM C-150 Specifications for Portland Cement.

B. Aggregates: All aggregates to meet ASTM C-33 specifications, cleaned and properly graded to size. Aggregate shall be blended to meet individual project requirements.

C. Marble chips, size to conform with NTMA gradation standards.

D. Coloring; Pigments used shall be inorganic, resistant to alkalinity and used per manufacturer's recommendations.

E. Reinforcement and Hardware:
   1. To conform with NTMA and Manufacturer's design.
   2. Reinforce precast with deformed rods or wire mesh or both as recommended by precast terrazzo manufacturer.

F. Abrasive Inserts: Shall consist of silica sand and black epoxy, three lines.

G. Caulks & Sealants:
   1. Urethane or Polyurethane Sealant
   2. Color to be selected by Architect from manufacturers standard colors.

H. Cleaner: Liquid neutral chemical cleaner, with pH factor between 7 and 8, of formulation recommended by sealer manufacture for type of precast terrazzo used and complying with NTMA requirements.

I. Sealer: Colorless, slip and stain-resistant penetrating sealer with pH factor between 7 and 8, that does not affect color or physical properties of precast terrazzo surface. Flash point (ASTM D56): 80 degrees F, Minimum.

2.03 MANUFACTURED UNITS

A. Sizing Tolerances:
   1. All units to conform to shop drawings with a 1/16" tolerance in dimension.

B. Precast Surfaces and Edges:
   1. All exposed edges to be ground and polished with a minimum of 1/16" bevel.

C. All finished surfaces to be ground and polished, free of holes and to have overall uniformity in matrix and aggregate.

D. All precast terrazzo finished surfaces to be sealed with a sealer approved by manufacturer.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine areas to receive precast terrazzo for the following:
   1. Defects in existing work.
   2. Deviations beyond allowable tolerances for the substrate.
   3. Start work only when all defects have been corrected by others.

3.02 INSTALLATION

A. Setting:
   1. Set accurately as shown on approved shop drawings. Setting methods are:
      a. Thin Set
      b. Weld
      c. Bolt
   2. Alignment of precast should be straight and true to all dimensions and may not vary more than 1/8" in length, height or width.
   3. Install anchors as shown on details.
   4. Fill joints between with manufacturer -approved caulk or as specified.

3.03 PROTECTION

A. Protect the finished terrazo work from damage by other trades.

B. Seal terrazzo finished surfaces with a sealer approved by manufacturer.

END OF SECTION

SECTION 09 66 23
EPOXY-RESIN TERRAZZO FLOORING

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes.
   1. Thin-set epoxy terrazzo.
   2. Precast, thin-set, epoxy terrazzo wall base units.
   3. Related accessories.
   4. Refinishing existing terrazzo floors.

1.02 RELATED REQUIREMENTS:

A. Section 01 74 19 – Construction Waste Management.

B. Section 01 81 13 – Sustainable Design Requirements.

C. Section 01 81 14 – Volatile Organic Compound (VOC) Limits For Adhesives, Sealants, Paints & Coatings.

D. Section 01 81 19 – Indoor Air Quality Requirements.

E. Section 03 30 00, Cast In Place Concrete.

F. Section 07 26 16, Under-slab Vapor Retarder/Barrier.

G. Section 07 90 00, Joint Protection.

1.03 REFERENCES

A. American Concrete Institute (ACI):
   1. ACI Committee No. 403 Bulletin Title No. 59-43.

B. American Society for Testing and Materials (ASTM):
   1. ASTM C131 "Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine."
   2. ASTM C1021 Standard Practice for Laboratories Engaged in the Testing of Building Sealants."
   3. ASTM C1093 Standard Practice for Accreditation of Testing Agencies for Masonry."
   4. ASTM D412 "Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension."
   5. ASTM D696 "Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between -30°C and 30°C With a Vitreous Silica Dilatometer."
   6. ASTM D1308 "Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes."
   7. ASTM D2240 "Standard Test Method for Rubber Property-Durometer Hardness."
   8. ASTM D2370 "Standard Test Method for Tensile Properties of Organic Coatings."
   9. ASTM E96 "Standard Test Methods for Water Vapor Transmission of Materials."
   10. ASTM F1869 "Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride."
   11. ASTM F2170 "Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes.".

C. The International Accreditation Service (IAS)

1. IAS or ILAC Mutual Recognition Arrangement as complying with ISO/IEC Standard 17025.

D. International Concrete Repair Institute (ICRI):
1. "Technical Guidelines 03732: Guide for Selecting and Specifying Surface Preparation for Sealers, Coatings, and Membranes."

E. The International Laboratory Accreditation Cooperation (ILAC).
1. IAS or ILAC Mutual Recognition Arrangement as complying with ISO/IEC Standard 17025.

F. International Masonry Institute (IMI).

G. International Organization for Standardization (ISO):
1. ISO 17025 "General Requirements for the Competence of Testing and Calibration Laboratories."

H. The National Terrazzo & Mosaic Association Inc. (NTMA):
1. “Terrazzo Specifications and Design Guide”
2. “Guide Specification for Epoxy Terrazzo”.
3. Technical Bulletin #111.

1.04 LEED REQUIREMENTS:

A. LEED Focus Materials (LFMs) For This Section:
1. Targeted products containing Recycled Content (MRc4)
2. Targeted products containing Regional Material (MRc5)
3. Targeted products to meet Low Emitting Flooring requirements (EQc4.3)

1.05 COORDINATION

A. Coordinate the types of traffic allowed on terrazzo between the following events:
1. Completion of pouring and before coarse grinding.
2. Completion of grouting and before polishing.

B. Coordinate the preparation for terrazzo work with the installation of plumbing, electrical, communications, and data work in the floor area to receive terrazzo.
1. Verify that fixtures, equipment, and outlets will be located properly and at the correct elevation.

1.06 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Prior to installation of concrete substrates, conduct conference at Project site to comply with requirements in Division 1. Review methods and procedures related to terrazzo including, but not limited to, the following:
1. Inspect and discuss installation procedures, joint details, jobsite conditions, substrate specification, vapor barrier details and coordination with other trades.
2. Review and finalize construction schedule and verify availability of materials, Installer’s personnel, equipment and facilities needed to make progress and avoid delays.
3. Review special terrazzo designs and patterns.
4. Review dust control procedures.
5. Review plans for concrete curing and site drying to enable timely achievement of suitable slab moisture conditions.
6. Review concrete substrate tolerance requirements for acceptable terrazzo installation.

1.07 SUBMITTALS

A. Product Data: Manufacturer's product data for each type of terrazzo and accessory including the following information:
   1. Physical properties.
   2. Performance properties.
   3. Independent Lab Testing for Moisture Mitigation System and Bond Strength Testing
   4. For tests not listed in published data, supply missing data according to standard referenced.

B. Refinishing Terrazzo Floors:
   1. Product Data: Provide data for sealer and cleaner and grout.
   2. Cleaning and Maintenance Data.

C. Shop Drawings: Include terrazzo installation requirements. Include plans, elevations, sections, component details and attachments to other work. Show layout of the following:
   1. Divider strips.
   2. Control- and expansion-joint strips.
   3. Base and border strips.
   4. Precast terrazzo-jointing and edge configurations including anchorage details.
   5. Terrazzo patterns.
   6. Layout of special graphic patterns.
   7. Large scale details of terrazzo patterns and metal or other material inserts.

D. Samples for Initial Selection: Provide Manufacturer's color plates showing the full range of colors and patterns available for each terrazzo type indicated.

E. Samples for Verification: For each type, material, color and pattern of terrazzo and accessory required showing the full range of color, texture and pattern variations expected. Label each terrazzo sample to identify manufacturer's matrix color and aggregate types, sizes and proportions. Prepare samples of same thickness and from same material to be used for the Work in size indicated below:
   1. Epoxy Terrazzo: minimum 6" x 6" (150 mm x 150 mm) sample of each color and type of terrazzo.
   2. Precast Epoxy Terrazzo: minimum 6" x 6" (150 mm x 150 mm) sample of each color and type of terrazzo.
   3. Accessories: 6" (150 mm) length of each kind of divider strip, stop strip and control joint strip required.

F. Qualification Data: For Installer and Manufacturer.

G. Material Test Reports: For moisture and/or relative humidity of substrate, by a qualified testing agency.

H. Preconstruction Examination Reports: For list conditions of in place substrate which will detrimental to performance of terrazzo flooring installation.

I. Sample Warranties: For manufacturer's special warranties.

J. LEED Product and Material Data Summary Form: For all installed products and materials of this Section, complete the "LEED Product and Material Data Summary Form" (attached to end of Section 01 81 13 - Sustainable Design Requirements)

1. Product Material Cost: Provide the cost for material, or an assembled product, including taxes and delivery but excluding any cost for labor and equipment required for installation after the material is delivered to the site.
2. Product Data for Credit MRc4, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating cost for each product having recycled content.
3. Product Data for Credit MRc5, Regional Material: For products having regional materials, documentation indicating location of raw material extraction, harvest or recovery, as well as, manufacture (location of final assembly) within 500 miles of project site. Include statement indicating cost for each material or component of the assembled product.
4. Product Data for Credit EQc4.3, Flooring: Certificates from product manufacturer or testing agency for flooring products indicating that they comply with the applicable standards.

1.08 CLOSEOUT SUBMITTALS

A. Maintenance Data: NTMA maintenance recommendations and manufacturer's instructions to include in maintenance manuals.

B. Repair Procedures: Provide written procedures for the following:
   1. Epoxy Terrazzo Flooring: Removal and replacing damaged portions of flooring.

1.09 QUALITY ASSURANCE

A. Manufacturer Qualifications: Engage a terrazzo manufacturer with minimum 5 years documented manufacturing experience producing epoxy binder, and flexible crack isolation membranes; including the following:
   1. Proof of NTMA membership.
   2. Furnish documentation for at least 5 epoxy terrazzo projects of the same scope and complexity; installed in the past 5 years using material being submitted for this project.
   3. For each epoxy terrazzo project submitted, provide the following information:
      a. Project name.
      b. Square footage of terrazzo installed.
      c. Lineal footage of precast base and cast in place base.
      d. Address of facility with contact name and phone number.
      e. Contact name, address and phone number of prime contractor or construction manager.
      f. Field experience resumes of key project personnel including lead supervisor and field technicians to be used on this project.

B. Installer Qualifications: Submit proof of Contractor's membership in NTMA or IMI with a letter recognizing that they are a qualified installer in good standing and is acceptable to epoxy terrazzo manufacturer.
   1. Furnish documentation for at least 3 epoxy terrazzo projects of the same scope and complexity; installed in the past 5 years using material being submitted for this project.

C. PATCHING HOLES IN TERRAZZO: If patching the existing terrazzo floor is necessary a sample should be made to match the exiting floor and a submittal sample sent to the architect prior to installation for approval. The manufacture materials used in the patch should be approved by NTMA and installed according to their standards. (For example, Master Terrazzo Morricite System)

1. The area needing a patched should be clean and free of all foreign materials.
2. Select matching aggregates and epoxy for color that matches existing terrazzo.
3. Install patch materials according to NTMA guidelines
4. Installer shall be a contractor member of NTMA and shall perform all work in accordance with NTMA standards

D. Testing Agency Qualifications: Qualified according to ASTM C1021 for testing indicated and accredited by IAS or ILAC Mutual Recognition Arrangement as complying with ISO/IEC Standard 17025.

E. Mockups: Build mockups to verify selections made under sample submittals; to demonstrate aesthetic effects; and to set quality standards for materials and execution.
1. Build mockup of typical terrazzo flooring installation as shown on Drawings.
a. Size: Minimum 100 sq. ft. (9 sq. m.) of typical poured-in-place flooring and base condition for each color and pattern in locations directed by Architect.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

F. Sustainability and LEED Standards Certification:
1. Regional manufactured products with percentage by weight.
2. Recycled content calculated as 1/2 preconsumer + postconsumer.
3. VOC content limitations defined in Section 018114, "Volatile Organic Compound (VOC) Limits For Adhesives, Sealants, Paints, and Coatings."
4. Low Emitting Flooring certification.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in manufacturer's undamaged, unopened containers with a label on each container clearly marked with the following information:
1. Product name
2. Manufacturer's name
3. Component designation (A or B, etc.)
4. Ratio of component mixture
5. CHEMTREC Emergency Response Information

B. Handle materials by methods which prevent damage.

C. Inspect direct jobsite deliveries to assure quantities are correct; materials comply with requirements; and materials are not damaged.

D. Immediately return materials found to be defective in manufacturing and materials damaged in transit, handling or storage.
1. Replace defective materials at no cost to Owner.

E. Store materials per manufacturer's instructions and as follows:
1. Store materials in their original, undamaged packages and containers, inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures and humidity.
2. Maintain storage temperatures between 60° F (15.6° C) and 90° F (32.2° C).

3. Maintain seals and labels intact and legible.
4. Do not use materials which have been stored for a longer period of time than the manufacturer's maximum recommended shelf life.

1.11 FIELD CONDITIONS

A. Temperature:
1. Maintain the ambient room and substrate temperature at 55° F (12.8° C) or above during stripping and pouring.
a. Maintain this temperature at least 48 hours after completion of pouring.
2. After terrazzo has been poured, maintain substrate temperature at 40° F (4.4° C) or above until substantial completion.
3. Each day of installation, before beginning work, verify that the dew point is at least 5° F (-15.0° C) less than the slab and air temperature.

B. Verify that adequate ventilation is provided.

C. Maintain a minimum uniform level of 50-60 foot candles (538.2 Lux - 645.8 Lux) in areas where terrazzo system is being installed.

D. Field Measurements, Precast Terrazzo: Verify actual dimensions of construction contiguous with precast terrazzo by field measurements before fabrication.

E. Acceptable Substrate Conditions:
1. Flatness Tolerance: Maximum variation from flatness of 1/4 inch in 10 feet (6 mm in 3 m).
2. Concrete floor Finish: Steel trowel finish.
3. Allow concrete to receive epoxy terrazzo to cure for at least 30 days before beginning installation process.
a. Allow no curing agents to be used in areas to receive terrazzo.
4. Test concrete substrate to determine acceptable moisture levels prior to terrazzo installation.

F. Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during terrazzo installation.

G. Close spaces to traffic during terrazzo application and for not less than 24 hours after application unless manufacturer recommends a longer period.

H. Provide protection from other trades prior to final acceptance by owner.

I. Dust Control: Control and collect dust produced by grinding operations.

1.12 WARRANTY

A. Special Warranty: Manufacturer and installer, jointly, agree to provide labor and material to repair (and if necessary to replace) components of epoxy terrazzo flooring system that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, loss of bond and damage due to normal wear and tear.
2. Failures do not include the following:
a. Damage due to bubbling or loss of adhesion due to moisture penetration through the substrate.
b. Acts of God or other elements beyond scope of protection of this system.
c. Reflective cracks from substrate.
3. Warranty Period: One year(s) from date of Substantial Completion.

4. Limitations:
   a. In case of warranty claim, Owner will provide written notice to terrazzo manufacturer and installer within 30 days of problem's discovery.
   b. Owner will provide free access to area during normal working hours.
   c. Owner assumes responsibility for protection and maintenance of epoxy terrazzo flooring from date of Substantial Completion on.
   d. Remedies provided by epoxy terrazzo flooring manufacturer and installer are limited to direct repair of Epoxy Terrazzo Flooring System.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design Products: Subject to compliance with requirements, provide products by Master Terrazzo Technologies, Levittown, PA (www.masterterrazzo.com) indicated in Part 2 Articles below or comparable products by one of the following:
   1. Crossfield Dex-O-Tex.
   2. General Polymers (a subsidiary of Sherwin Williams).

B. Source Limitations: Obtain primary Epoxy Terrazzo Flooring System materials including membranes, primers, resins, and hardening agents from a single manufacturer.
   1. Obtain aggregates, solvents, divider strips, sealers and cleaners from source recommended by primary materials manufacturer.

2.02 PERFORMANCE REQUIREMENTS

A. NTMA Standards: Comply with NTMA's "Terrazzo Specifications and Design Guide" and with written recommendations for terrazzo type indicated unless more stringent requirements are specified.

2.03 EPOXY TERRAZZO FLOORING SYSTEM

A. Materials:
   1. Epoxy Resin: Manufacturer’s standard recommended for use indicated and in color required for mix indicated.
      a. Physical Properties without Aggregates:
         1) Hardness: ASTM D2240 70-85 Shore D
         2) Minimum Tensile Strength: 4,800 psi (33 mPA) per ASTM D638 for a 2-inch (50 mm) specimen made using a “C” die per ASTM D412.
         3) Minimum Compressive Strength: 12,000 psi (83 mPA) per ASTM D695, Specimen B cylinder.
         4) Chemical Resistance: No deleterious effects by contaminants listed below after 7-day immersion at room temperature per ASTM D1308.
            (a) Distilled water
            (b) Mineral water
            (c) Isopropanol
            (d) Ethanol
            (e) 0.025 percent detergent solution
            (f) 1 percent soap solution
            (g) 10 percent sodium hydroxide
            (h) 10 percent hydrochloric acid

(i) 5 percent acetic acid

b. Physical Properties with Aggregates: For resin blended with Georgia White marble, ground, grouted, and cured per requirements in NTMA's "Guide Specification for Epoxy Terrazzo," comply with the following:

1) Flammability: Self-extinguishing, maximum extent of burning 0.25 inch (6 mm) per ASTM D635.

2) Linear Coefficient of Thermal Expansion: 25.0x10-6 in/in per ºF (11.4x10-7 cm/cm per ºC) for temperature range of -12° to 140° F (-24° to 60° C) per ASTM D696.

3) Bond Strength: When tested in accordance with Field Test Method for surface soundness and adhesion as described in ACI Committee No. 403 Bulletin Title No. 59-43 the Epoxy terrazzo shall comply with the following value: 100 percent concrete failure minimum, with 300 psi (2.1 mPA) minimum tensile strength.

2. Aggregate Chips: Marble, Granite, Glass, Synthetic, and Mother of Pearl:

a. Sizes: #2's, #1's and #0's, conforming to NTMA gradation standards.

b. Abrasion and Impact Resistance: ASTM C131-89; maximum 40 percent loss.

c. Chips shall contain no deleterious or foreign matter.

B. Mix: Comply with NTMA's "Terrazzo Specifications and Design Guide" and manufacturer's written instructions for matrix and aggregate proportions and mixing.

1. Color and Pattern Schedule: Where the following designations are indicated, provide specified terrazzo matrices matching architect's samples.

2. Recycled glass not to exceed 20% of the mix.

3. Allow for minimum two mix types without additional cost to owner.

2.04 DIVIDER AND ACCESSORY STRIPS

A. Thin -Set Divider Strips: L-type and T-type.

1. Material: White zinc alloy, .

2. Top Width: 1/16 inch (1.6 mm) and 1/8 inch (3 mm).

B. Heavy-Top Divider Strips: Angle type in depth required for topping thickness indicated.

1. Bottom-Section Material: Matching top-section material.

2. Top-Section Material: White zinc alloy, unless otherwise indicated.

3. Top-Section Width: 1/8 inch (3 mm), unless otherwise indicated.

C. Control joint Strips: Separate, double L-type divider strips, positioned back to back with 3/8 inch (9.5 mm) separation filled will sealant.

D. Accessory Strips: Match divider-strip width, material, and color unless otherwise indicated. Provide the following types of accessory strips:

1. Base bead and base dividers.

2.05 MISCELLANEOUS PRODUCTS

A. Concrete Patch and Topping: 100 percent solids fill mortar system including blended aggregate.

1. Basis of Design Product: MorriFill™ Epoxy Slope and Fill Mortar.

2. Compressive Strength: ASTM C579, 8,000 psi (55 mPA) minimum.

3. Hardness: ASTM D2240, 75-80 Shore D

B. Moisture Remediation System: Two-component formulation designed to reduce moisture vapor transmission through concrete and provide bond with epoxy terrazzo flooring system.

1. Basis of Design: Morricite MVP™ Moisture Suppression System by Master Terrazzo Technologies.
2. Adhesion: ASTM D4541, 500 psi (3.5 mPA).
3. Moisture Vapor Transmission: ASTM E96, 0.131 perm.

C. Primer: 100 percent solids, epoxy primer moisture insensitive. No solvent containing primers are allowed
   1. Basis of Design Product: Morricite® Primer.
   2. Moisture Vapor Transmission: ASTM E96, 1 perm maximum.

D. Crack Isolation Membrane
   1. Basis of Design Product: MasterFlex™ Flexible Epoxy Membrane.
   2. Flexible Epoxy Membrane: Flexible epoxy membrane with 100 percent solids with the following properties:
      a. Tensile Strength: ASTM D2370 at 68° F (20° C) 1,500 psi (10 mPA).
      b. Elongation: ASTM D2370 at 68° F (20° C) 130 percent.
      c. Adhesion: ASTM D4541, 350 psi (2.4 mPA)

E. Membrane Reinforcing: Fiberglass mesh reinforcement fabric compatible with crack isolation membrane.
   1. Basis of Design Product: MasterFlex™ Fabric.

F. Divider-Strip Adhesive: Epoxy-resin adhesive recommended by adhesive manufacturer for this use and acceptable to terrazzo manufacturer.
   1. Use adhesive that has a VOC content of 50g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

G. Anchoring Devices:
   1. Strips: Provide mechanical anchoring devices for strip materials as required for secure attachment to substrate.
   2. Precast Terrazzo: Provide mechanical anchoring devices as recommended by Terrazzo Contractor for proper anchorage and support of units for conditions of installation and support.

H. Finishing Grout: Epoxy grout with 100 percent Solids.
   1. Basis of Design Product: Morricite® Terrazzo Grout.

I. Control Joint Filler: Flexible, grindable, epoxy joint filler, 100 percent solids, with the following properties:
   1. Basis of Design Product: MTT ColorFlex™.
   2. Tensile Strength: ASTM D2370 at 68° F (20° C) 1,600 psi (11 mPA)
   3. Elongation: ASTM D2370 at 68° F (20° C) 100 percent
   4. Tensile Modulus: ASTM D2370 at 68° F (20° C) 27,800 psi (192 mPA)
   5. Color: As selected by the Architect.

J. Joint Sealant: MTT ColorFlex™ flexible sealant.

K. Expansion Joints: Comply with requirements of Section 07 92 00 "Joint Sealants".

L. Terrazzo Cleaner: As recommended by cleaner manufacturer for use on terrazzo type specified and as follows:
   1. Biodegradable
   2. Chemically neutral

3. pH factor between 7 and 10
4. Free from phosphate, crystallizing salts, and water soluble alkaline salts.

M. Terrazzo Sealers: Slip- and stain-resistant impregnating sealer that meets standard coefficient of friction of 0.6 or higher, does not affect physical properties of terrazzo and complies with NTMA's "Terrazzo Specifications and Design Guide."
1. General: Provide sealers approved by terrazzo flooring system manufacturer.

2.06 REFINISHING TERRAZZO FLOORS

A. Materials
1. Cleaner: Potable water, free of iron
2. Sealer: Penetrating liquid type to completely seal matrix surface; not detrimental to terrazzo components.
3. If patching of floor is needed use Master Terrazzo Technologies Morricite System epoxy and materials.

B. Equipment
1. All work shall be executed with conventional terrazzo grinding equipment according to trade practice. No lighter type machines, such as floor scrubbing machines, will be accepted.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and areas, with Terrazzo Contractor present, for compliance with requirements for installation tolerances and other conditions affecting performance.
1. Evaluate slab condition, including slab moisture content and extent of repairs required to comply with substrate requirements of NTMA's "Terrazzo Specifications and Design Guide" and the requirements of this Section.
2. Verify that concrete substrate was poured no fewer than 30 days prior to date of examinations.
3. Verify existing work has no defects affect proper execution of terrazzo work.
4. Verify that concrete substrate meets flatness tolerances.
5. Verify that concrete substrates are visibly dry and free of moisture.

B. Prepare written preconstruction examination report, endorsed by Installer, listing conditions detrimental to performance.

C. Proceed with installation only after unsatisfactory conditions, including flatness tolerances, have been corrected.

D. Verify measurements and dimensions; coordinate the installation of insert and work of other trades.

3.02 PREINSTALLATION TESTING

A. Concrete Moisture Testing, General
1. Conduct relative humidity test at each test site.
2. Conduct one pH test at each test site.

B. Calcium Chloride Testing:
1. Perform tests in accordance with ASTM F1869.

C. Relative Humidity Testing:
1. Perform tests in accordance with ASTM F2170.
2. Conduct relative humidity testing at the following depths:

a. Basement Slabs and Slabs-On-Grade: Measure temperature and relative humidity at 40 percent of slab thickness measured from top surface.
b. Elevated Slabs: Measure temperature and relative humidity at 20 percent of slab thickness measured from top surface.

3. Drill test hole at each test site to accommodate test sleeve.
4. Hole Diameter: In accordance with test equipment manufacturer's instructions.
5. Drilling Fluids: Not permitted.
6. Vacuum dust and debris from test hole.
7. Insert sleeve, to the full depth of test hole. Cap or plug sleeve to prevent test hole contamination.
8. Permit the test site to acclimate for minimum 72 hours before measuring relative humidity.
9. Remove sleeve plug and insert probe to bottom of test hole. Allow test probe to reach temperature equilibration with concrete slab.
10. Measure and record temperature and relative humidity at the test site.

D. Proceed with terrazzo installation only after substrates have a maximum relative humidity measurement reading less than 80 percent.
1. If concrete substrate moisture exceeds 80% according to ASTM F2170, consult terrazzo manufacturer for additional drying or negative side moisture remediation methods.
2. Provide manufacturer recommended negative side moisture remediation at all slabs on grade scheduled to receive epoxy terrazzo.

3.03 PREPARATION

A. Clean substrates of substances, including oil, grease and curing compounds, that might impair terrazzo bond. Provide clean, dry and neutral substrate for terrazzo application.

B. Provide clean, dry, and neutral substrate for terrazzo application.
1. Determine dryness characteristics by performing moisture tests recommended by terrazzo manufacturer.

C. Concrete Slabs:
1. Provide sound concrete surface free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil and other contaminants incompatible with epoxy terrazzo.
a. Prepare concrete mechanically by shot blasting or by grinding.
1) Surface preparation results should achieve a CSP3-CSP4 profile according to International Concrete Repair Institute Guideline No. 03732.
b. Remove contaminating and bond breaking substances including but not limited to the following:
1) Dust.
2) Laitance.
3) Curing compounds.
4) Coatings.
5) Sealers.
6) Oil.
7) Grease.
8) Mastics.

9) Adhesives.

c. Chemically remove oil and grease not removed by vacuum blasting.

d. Mechanically remove spalled and deteriorated concrete with scabbling or chipping hammers.

e. Do not acid etch concrete.

f. Repair or level damaged concrete with concrete patch and topping.

g. Do not use latex fills and self-leveling underlayments.

h. Cracks and non-expansion joints greater than 1/16 inch (1.6 mm) wide after surface preparation shall be prepared until sound.

1) Repair cracks and non-expansion joints according to NTMA Technical Bulletin #111.

D. Protect other work from dust generated by shot blasting and grinding operations. Control dust to prevent air pollution and comply with environmental protection regulations.

1. Erect and maintain temporary enclosures and other suitable methods to limit dust migration and to ensure adequate ambient temperatures and ventilation conditions during installation.

E. Protect other work from dust generated by grinding operations. Control dust to prevent air pollution and comply with environmental protection regulations.

1. Erect and maintain temporary enclosures and other suitable methods to limit dust migration and to ensure adequate ambient temperatures and ventilation conditions during installation.

F. Apply one coat of moisture remediation system over concrete surface prepared to receive epoxy-resin terrazzo flooring according to manufacturer's written instructions where indicated on drawings.

3.04 REFINISHING TERRAZZO FLOORS

A. General

1. Perform work in accordance with NTMA recommendations as posted on their website at www.ntma.com.

B. Preparation

1. Cover and protect all adjacent finished surfaces during restoration process.

C. Crack Repair

1. Clean cracks by mechanical means (like metal dental pick or fine “Dremel” tooling) to remove dirt, debris and sealers - "V" shape routing out or significant widening is not recommended..

2. Grout cracks to match existing matrix prior to initial grinding.

D. Initial Grinding

1. Terrazzo Contractor must access flooring condition prior to Grinding to determine the condition of the floor and determine steps of grinding. If the condition of the floor has years of sealer on the surface a heavy grind may be needed to remove old stains and sealers, etc. This will require using grinding diamond pad with 60-80 grit stone - all in the presence of water. If the floor is in good condition and has been maintained properly you may want to start with 150 to 200 grit diamond pads. (The final polish is achieved by grinding at 400 grit with diamond pads.)

E. Grouting

1. Cleanse floor with ample clean water and rinse.

2. Remove excess rinse water and machine or hand-apply grout, with color added to match the matrix of the terrazzo floor, taking care to fill voids. IF VOIDS ARE NOT FILLED REGROUT THE FLOOR AREA A SECOND TIME.

F. Curing Grout
1. The grout shall remain on the surface until fully cured, commonly a minimum of 12 hours or so at 70 degrees F.

G. Fine Grinding
1. Grind with 120-220 grit diamond/stones until all grout has been removed from the terrazzo surface. EXTRA PRECAUTION SHOULD BE TAKEN NOT TO OVER GRIND THE FLOOR.
2. The final polish will be done at 400 grit, using diamond grinding pads, or higher.

H. Cleaning and Sealing
1. Rinse with clean water and allow to thoroughly dry.
2. Seal: Apply penetrating sealer, per manufacturer's directions by a qualified manufacturer such as Master Terrazzo.
3. Upon completion, this work shall be ready for final inspection and acceptance by the owner.
4. Remove protection and clean any adjacent surfaces effected by the refinishing process.

3.05 INSTALLATION, EPOXY TERRAZZO

A. General:
1. NTMA Standards: Comply with NTMA's "Terrazzo Specifications and Design Guide" and with written recommendations for terrazzo type and accessory indicated unless more stringent requirements are specified within this section.
2. Comply with written directions of product manufacturer.
3. Ensure that matrix components and fluids from grinding operations do not stain terrazzo by reacting with divider and control joint strips.
4. Delay fine grinding until heavy trade work is complete and construction traffic through area is restricted.

B. Full Membrane Application
1. Flexible Reinforcing Membrane:
   a. Prepare and prefill substrate cracks with concrete patch and topping material or with primer and allow to cure.
   b. Apply 25 mils of crack isolation membrane over prepared substrate to produce full substrate coverage in areas to receive terrazzo.
   c. Apply second coat of crack isolation membrane, 15 mils thick and install reinforcing fabric.
   d. Prepare membrane according to manufacturer's written instructions before applying primer.
2. Primer: Install primer if required by manufacturer over crack isolation membrane.

C. Crack Detailing Application
1. Crack Treatment : After surface preparation, fill less than 1/16 inch (1.6 mm) wide with crack isolation membrane. Apply detail coat of crack isolation membrane over cracks and embed 12 inches (300 mm) wide strips of membrane reinforcing fabric.

2. Crack Treatment : Fill cracks and joints which are greater than 1/16 inch (1.6 mm) width with crack isolation membrane or primer.
   a. Apply minimum 30 mil detail coat of crack isolation membrane. Extend coverage at least 12 inches (300 mm) on each side of crack.
   b. After crack isolation membrane has leveled, lay minimum 9 inches (230 mm) wide precut strips of membrane reinforcing fabric into uncured crack isolation membrane. Saturate reinforcing fabric with additional crack isolation membrane.
3. Primer: Apply epoxy primer evenly over entire prepared substrate, including cracks and non-expansion joints, at a rate of 200-250 square feet per gallon (5 - 6 sq. m per liter).
   a. Thoroughly wet surface with primer.
   b. Do not allow primer to pond.

D. Divider and Accessory Strips: Install in locations indicated in adhesive setting bed without voids below strips.
   1. Anchoring Strips: Adhere the strips to the floor with primer or hot glue.

E. Control Joint Strips: Provide one of the following where indicated:
   1. Back to Back Strips: Install L-type divider strips back to back over full membrane parallel to control and non-doweled construction joints leaving a space appropriate for anticipated movement - typically 1/4 to 3/8 inch (6 to 9.5 mm) according to NTMA Technical Bulletin #111, Detail #1.
      a. Fill gap between control joints with joint sealant.
   2. Single Strip: Fill saw cut joint with control joint filler. Place L-type divider strip on concrete adjacent to joint according to NTMA Technical Bulletin #111, Detail 2.

F. Placing Terrazzo:
   1. Mix terrazzo binder with chips and fillers in ratios as approved by manufacturer.
   2. Trowel-apply terrazzo mixture over epoxy primer to provide smooth seamless surface at a minimum of 3/8 inch (9.5 mm) thick.
      a. Allow terrazzo mixture to cure per manufacturer's recommendations prior to grinding operations.

G. Rough Grinding: Grind with 24 grit or finer stones or with comparable diamond plates.

H. Intermediate Grinding: Follow initial grind with 80 grit or finer stones .

I. Grouting: Prior to final grinding, apply epoxy grout as follows:
   1. Cleanse floor with clean water and rinse thoroughly.
   2. Remove excess rinse water by wet vacuum and machine until completely dry.
   3. Apply epoxy grout to fill voids.

J. Fine Grinding: Grind with 800 grit stones until all grout is removed from surface.
   1. Repeat rough grinding, grout coat, and fine grinding if large voids exist after initial fine grinding.
   2. Produce surface with a minimum of 70 percent aggregate exposure.

K. Remove terrazzo in areas where terrazzo fails to bond properly to substrate and install new terrazzo.
   1. Cut out terrazzo areas in panels defined by strips and replace to match adjacent terrazzo.

L. Construction Tolerances: Limit variation in terrazzo surface from flat to 1/4 inch in 10 feet (6 mm in 3 m).

3.06 INSTALLATION, PRECAST TERRAZZO

A. Set units using method recommended by NTMA and by epoxy terrazzo flooring manufacturer unless otherwise indicated.

B. Set units with alignment level and true to dimensions, varying 1/8 inch (3.2 mm) maximum in length, height, or width.

C. Seal joints between units with joint sealants.

3.07 ADJUSTING

A. Cut out and replace terrazzo areas that evidence lack of bond with substrate. Cut out terrazzo areas in panels defined by strips and replace to match adjacent terrazzo, or repair panels according to NTMA's written recommendations, as approved by Architect.

3.08 CLEANING

A. Cleaning:
   1. Wash surfaces with cleaner according to NTMA's Maintenance Guide and manufacturer's written instructions.
   2. Remove grinding dust from installation and wash surfaces according to manufacturers recommended cleaning procedures.
   3. Allow surfaces to thoroughly dry before sealing.

3.09 PROTECTION

A. Protect surrounding substrates and surfaces, as well as in-place equipment from damage during surface preparation and system application.

B. Maintain area where terrazzo work is being done be free of other trades during surface preparation, crack detailing, divider strip installation, terrazzo pouring, and for a period of 36 hours upon completion.

C. Sealing:
   1. Seal surfaces according to NTMA's written recommendations.
   2. Apply terrazzo sealer according to sealer manufacturer's written instructions.

D. Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensure terrazzo is without damage or deterioration at time of Substantial Completion.

END OF SECTION

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SECTION 09 68 13
TILE CARPETING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Carpet tile, fully adhered.

B. Walk-off carpet tile

1.02 RELATED REQUIREMENTS

A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 01 74 19 - Construction Waste Management and Disposal: Reclamation/Recycling of new carpet tile scrap.

C. Section 09 0561 - Common Work Results for Flooring Preparation: Independent agency testing of concrete slabs, cleaning, and preparation.

1.03 REFERENCE STANDARDS

A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials; 2016.

B. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2015.

C. CRI (CIS) - Carpet Installation Standard; Carpet and Rug Institute; 2009.

D. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2015.

1.04 LEED FOCUS MATERIALS (LFMS) FOR THIS SECTION:

A. Targeted products containing Recycled Content (MRc4)

B. Targeted products containing Regional Material (MRc5)

C. Targeted products to meet VOC requirements (EQc4.1 & EQc4.2)

D. Targeted products to meet Low Emitting Flooring requirements (EQc4.3)

1.05 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

C. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.

D. Manufacturer's Installation Instructions: Indicate special procedures.

E. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

F. LEED Product and Material Data Summary Form: For all installed products and materials of this Section, complete the “LEED Product and Material Data Summary Form” (attached to end of Section 01 81 13 - Sustainable Design Requirements)

1. Product Material Cost: Provide the cost for material, or an assembled product, including taxes and delivery but excluding any cost for labor and equipment required for installation after the material is delivered to the site.
2. Product Data for Credit MRc4, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating cost for each product having recycled content.
3. Product Data for Credit MRc5, Regional Material: For products having regional materials, documentation indicating location of raw material extraction, harvest or recovery, as well as, manufacture (location of final assembly) within 500 miles of project site. Include statement indicating cost for each material or component of the assembled product.
4. Product Data for Credit EQc4.1, Adhesives & Sealants: For adhesives and sealants, documentation including printed statement of VOC content and chemical components.
5. Product Data for Credit EQc4.3, Flooring: Certificates from product manufacturer or testing agency for flooring products indicating that they comply with the applicable standards.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet tile with minimum three years documented experience.

B. Installer Qualifications: Company specializing in installing carpet tile with minimum three years documented experience and approved by carpet tile manufacturer.

C. Sustainability and LEED Standards Certification:
   1. Regional manufactured products with percentage by weight.
   2. Recycled content calculated as 1/2 preconsumer + postconsumer.
   3. VOC content limitations defined in Section 018114, "Volatile Organic Compound (VOC) Limits For Adhesives, Sealants, Paints, and Coatings."
   4. Low Emitting Flooring certification.

1.07 FIELD CONDITIONS

A. Store materials in area of installation for minimum period of 24 hours prior to installation.

PART 2 PRODUCTS

2.01 MATERIALS

A. Carpet Tile Type CPT-1, CPT-2, CPT-3, CPT-4, CPT-7, CPT-8, CPT-9, CPT-10: Tufted, Textured Loop, manufactured in one color dye lot.
   1. Product: Common Thread manufactured by Milliken.
   2. Tile Size: 20 by 20 inch, nominal.
   3. Thickness: 0.083 - 0.085 inches.
   4. Pattern: As indicated on drawings.
   5. Color: As indicated on drawings.
   6. Critical Radiant Flux: Minimum of 0.45 watts/sq cm, when tested in accordance with ASTM E648 or NFPA 253.
   7. Surface Flammability Ignition: Self-Extinguishing, when tested in accordance with ASTM D2859 (the "pill test").
   8. Max. Electrostatic Charge: < 3.5KV, Permanent Conductive Fiber.
   9. Primary Backing Material: PVC-Free Underscore ES Cushion

10. Installation Method: Monolithic, Ashlar, or Vertical Ashlar

B. Carpet Tile Type CPT-5, CPT-6: Tufted, Textured Loop, manufactured in one color dye lot.
1. Product: Theory 2.0 manufactured by Milliken.
2. Tile Size: 40 by 40 inch, nominal.
3. Thickness: 0.11 inch.
4. Pattern: As indicated on drawings.
5. Color: As indicated on drawings.
6. Critical Radiant Flux: Minimum of 0.45 watts/sq cm, when tested in accordance with ASTM E648 or NFPA 253.
7. Surface Flammability Ignition: Pass ASTM D2859 (the "pill test").
8. Max. Electrostatic Charge: 1.8 Kv. at 20 percent relative humidity.
9. Pile Weight: 20 oz/sq yd (678 gm/sq m).
10. Primary Backing Material: PVC-Free Underscore ES Cushion.
11. Installation Method: Monolithic

C. Textile Composite Floor Tile Type TCT-1, TCT-2, TCT-3, TCT-4, TCT-5, TCT-6: Thermally Fused, manufactured in one color dye lot.
1. Product: Kinetex manufactured by J + J Flooring Group.
2. Tile Size: 24 by 24 inch, nominal.
3. Thickness:.205 inch.
4. Color: As indicated on drawings.
5. Pattern: As indicated on drawings.
6. Total Weight: 4.5 oz. - 5.2 oz/sq ft.

D. Walk-off Entry Carpet Tile Type WOC-1: Tufted, Cut Pile.
1. Product: Quadrus manufactured by Milliken.
2. Tile Size: 20 by 20 inch, nominal.
3. Thickness: 0.182 inch.
4. Color: As indicated on drawings.
5. Pattern: As indicated on drawings.
6. Antimicrobial: AlphaSan AF Built-In Protection

2.02 ACCESSORIES

A. Sub-Floor Filler: White premix latex; type recommended by flooring material manufacturer.

B. Edge Strips: Rubber, color as selected by Architect.

C. Carpet Tile Adhesive: Recommended by carpet tile manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.

B. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to sub-floor surfaces.

C. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for flooring installation by testing for moisture and pH.
1. Test in accordance with Section 09 05 61.

2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.

3.02 PREPARATION

A. Prepare floor substrates for installation of flooring in accordance with Section 09 05 61.

3.03 INSTALLATION

A. Starting installation constitutes acceptance of sub-floor conditions.

B. Install carpet tile in accordance with manufacturer's instructionsand CRI Carpet Installation Standard.

C. Blend carpet from different cartons to ensure minimal variation in color match.

D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.

E. Lay carpet tile in square pattern or as scheduled and shown, with pile direction parallel to next unit, set parallel to building lines.

F. Fully adhere carpet tile to substrate.

G. Trim carpet tile neatly at walls and around interruptions.

H. Complete installation of edge strips, concealing exposed edges.

3.04 CLEANING

A. Remove excess adhesive without damage, from floor, base, and wall surfaces.

B. Clean and vacuum carpet surfaces.

END OF SECTION

SECTION 09 68 16
SHEET CARPETING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Carpet, direct-glued.

B. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 09 05 61 - Common Work Results for Flooring Preparation: Independent agency testing of concrete slabs, removal of existing floor coverings, cleaning, and preparation.

1.03 REFERENCE STANDARDS

A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials; 2016.

B. CRI 104 - Standard for Installation of Commercial Carpet; 2015.

C. CRI (GLP) - Green Label Plus Testing Program - Certified Products; www.carpet-rug.org; current edition.

1.04 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

C. Samples: Submit two samples 12 by 12 inch in size illustrating color and pattern for each carpet material specified.

D. Manufacturer's Installation Instructions: Indicate special procedures.

E. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 60 00 - Product Requirements, for additional requirements.
2. Extra Carpet: 50 sq ft of each type, color, and pattern installed.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet with minimum three years documented experience.

B. Installer Qualifications: Company specializing in installing carpet with minimum three years documented experience.

1.06 FIELD CONDITIONS

A. Store materials in area of installation for minimum period of 24 hours prior to installation.

B. Maintain minimum 70 degrees F ambient temperature 24 hours prior to, during and 24 hours after installation.

C. Ventilate installation area during installation and for 72 hours after installation.

PART 2 PRODUCTS

2.01 CARPET

A. Carpet, Type BL-1: Broadloom
   1. Product: Stack 9 manufactured by Tandus-Centiva.
   2. Roll Width: 6 ft.
   3. Color: As indicated on drawings.
   4. Pattern: As indicated on drawings.

2.02 ACCESSORIES

A. Sub-Floor Filler: Type recommended by carpet manufacturer.

B. Moldings and Edge Strips: Rubber, color as selected.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive carpet.

B. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of adhesives to sub floor surfaces.

C. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for flooring installation by testing for moisture and alkalinity (pH).
   1. Test in accordance with Section 09 05 61.
   2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.

3.02 PREPARATION

A. Prepare floor substrates for installation of flooring in accordance with Section 09 05 61.

3.03 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of sub-floor conditions.

B. Install carpet and cushion in accordance with manufacturer's instructions and CRI 104 (Commercial).

C. Verify carpet match before cutting to ensure minimal variation between dye lots.

D. Lay out carpet and locate seams in accordance with shop drawings.
   1. Locate seams in area of least traffic, out of areas of pivoting traffic, and parallel to main traffic.
   2. Do not locate seams perpendicular through door openings.
   3. Align run of pile in same direction as anticipated traffic and in same direction on adjacent pieces.
   4. Locate change of color or pattern between rooms under door centerline.
   5. Provide monolithic color, pattern, and texture match within any one area.

E. Install carpet tight and flat on subfloor, well fastened at edges, with a uniform appearance.

3.04 DIRECT-GLUED CARPET

A. Double cut carpet seams, with accurate pattern match. Make cuts straight, true, and unfrayed. Apply seam adhesive to cut edges of woven carpet immediately.

B. Apply contact adhesive to floor uniformly at rate recommended by manufacturer. After sufficient open time, press carpet into adhesive.

C. Apply seam adhesive to the base of the edge glued down. Lay adjoining piece with seam straight, not overlapped or peaked, and free of gaps.

D. Roll with appropriate roller for complete contact of adhesive to carpet backing.

E. Trim carpet neatly at walls and around interruptions.

F. Complete installation of edge strips, concealing exposed edges. Bind cut edges where not concealed by edge strips.

3.05 CLEANING

A. Remove excess adhesive from floor and wall surfaces without damage.

B. Clean and vacuum carpet surfaces.

END OF SECTION

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SECTION 09 72 00
WALL COVERINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall covering and borders.

1.02 RELATED REQUIREMENTS

A. Section 09 91 23 - Interior Painting: Preparation and priming of substrate surfaces.

1.03 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.

B. ASTM F793/F793M - Standard Classification of Wall Coverings by Use Characteristics; 2015.

1.04 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Product Data: Provide data on wall covering and adhesive.

C. Shop Drawings: Indicate wall elevations with seaming layout.

D. Samples: Submit two samples of wall covering, 6 by 6 inch in size illustrating color, finish, and texture.

E. Test Reports: Indicate verification of flame and smoke ratings, when tested by UL.

F. Manufacturer's Installation Instructions: Indicate special procedures.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 60 00 - Product Requirements, for additional provisions.
2. Extra Wall Covering Materials: 25 linear feet of each color and pattern of wall covering; store where directed.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Inspect roll materials at arrival on site, to verify acceptability.

B. Protect packaged adhesive from temperature cycling and cold temperatures.

C. Do not store roll goods on end.

1.07 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the adhesive or wall covering product manufacturer.

B. Maintain these conditions 24 hours before, during, and after installation of adhesive and wall covering.

PART 2 PRODUCTS

2.01 WALL COVERINGS

A. General Requirements:
   1. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84.

B. Wall Covering - Type VWC-1, VWC-2, VWC-3: Fabric-backed vinyl roll stock.
   1. Conform to ASTM F793/F793M, Category V, Type II.
   2. Total Weight: 13.3 oz/sq yd.
   3. Pattern: As indicated on drawings.
   4. Pattern Match: Random
   5. Manufacturers:
      a. Basis of Design: Lanark Wallcovering; Axiom: www.lanark.com
      b. Koroseal/RJF International: www.koroseal.com.
      c. MDC Wallcoverings: www.mdcwall.com.
      d. Wolf-Gordon: www.wolfgordon.com.
      e. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate surfaces are prime painted and ready to receive work, and conform to requirements of the wall covering manufacturer.

B. Verify flatness tolerance of surfaces does not vary more than 1/8 inch in 10 feet nor vary at a rate greater than 1/16 inch/ft.

3.02 PREPARATION

A. Wash impervious surfaces with tetra-sodium phosphate, rinse and neutralize; wipe dry.

B. Surface Appurtenances: Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.

C. Vacuum clean surfaces free of loose particles.

3.03 INSTALLATION

A. Apply adhesive and wall covering in accordance with manufacturer's instructions.

B. Apply adhesive to wall surface immediately prior to application of wall covering.

C. Apply wall covering smooth, without wrinkles, gaps or overlaps. Eliminate air pockets and ensure full bond to substrate surface.

D. Butt edges tightly.

E. Horizontal seams are not acceptable.

F. Remove excess adhesive while wet from seam before proceeding to next wall covering sheet. Wipe clean with dry cloth.

3.04 CLEANING

A. Clean wall coverings of excess adhesive, dust, dirt, and other contaminants.

B. Reinstall wall plates and accessories removed prior to work of this section.

3.05 PROTECTION

A. Do not permit construction activities at or near finished wall covering areas.

END OF SECTION

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SECTION 09 81 00
ACOUSTICAL INSULATION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: Acoustic insulation used alone or in conjunction with other materials to provide acoustical isolation.

B. Related Sections:
1. Section 01 74 19 – Construction Waste Management.
2. Section 01 81 19 – Indoor Air Quality Requirements.
3. Section 07 21 00 - Thermal Insulation.
4. Section 09 21 16 - Gypsum Board: Acoustical batt insulation in cavity walls.
5. Section 09 84 00 - Acoustic Room Components.

1.02 LEED REQUIREMENTS

A. LEED Focus Materials (LFMs) For This Section:
1. Targeted products containing Recycled Content (MRc4)
2. Targeted products containing Regional Material (MRc5)

1.03 SUBMITTALS

A. Product Data: Submit product data for insulation types.

B. Shop Drawings: Submit shop drawings of insulation used in assemblies, indicating thickness, attachment, and finish material.

C. Samples:
1. Submit 12 by 12 inch samples of each color specified for Architect's verification.

D. Submit following Informational Submittals:
1. Test Reports:
a. Submit independent laboratory sound transmission test report on letterhead of testing laboratory.
b. Submit certified test reports on composite fabric and backing flame spread and smoke contribution.
2. Certifications specified in Quality Assurance article.
3. Qualification Data: Manufacturer's qualification data.
4. Manufacturer's instructions.
5. Manufacturer's field reports.

E. Closeout Submittals:
1. Maintenance data.

F. LEED Product and Material Data Summary Form: For all installed products and materials of this Section, complete the “LEED Product and Material Data Summary Form” (attached to end of Section 01 81 13 - Sustainable Design Requirements)
1. Product Material Cost: Provide the cost for material, or an assembled product, including taxes and delivery but excluding any cost for labor and equipment required for installation after the material is delivered to the site.
2. Product Data for Credit MRc4, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer

recycled content. Include statement indicating cost for each product having recycled content.

3. Product Data for Credit MRc5, Regional Material: For products having regional materials, documentation indicating location of raw material extraction, harvest or recovery, as well as, manufacture (location of final assembly) within 500 miles of project site. Include statement indicating cost for each material or component of the assembled product.

1.04 QUALITY ASSURANCE

A. Sustainability and LEED Standards Certification:
   1. Regional manufactured products with percentage by weight.
   2. Recycled content calculated as 1/2 preconsumer + postconsumer.
   3. VOC content limitations defined in Section 018114, "Volatile Organic Compound (VOC) Limits For Adhesives, Sealants, Paints, and Coatings."

1.05 FIELD SAMPLES

A. Sample Installation:
   1. Install 2 full size panels in area designated by Architect.
   2. Show edge treatment, applied mesh, and hanging techniques.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Immediately inspect material upon arrival at site for defects and damage.

B. Safeguard against disfiguration, contamination, and damage by physical abuse or abuse from other harmful materials.

C. Store materials in clean, dry area, and protect from construction traffic.

PART 2 - PRODUCTS

2.01 ACOUSTICAL INSULATION TYPES

A. Acoustical Insulation - Cavity Insulation for Sound Rated Partitions. Refer to Section 092900 Gypsum Board.

B. Acoustical Insulation - Fabric Wrapped Acoustical Panels for walls and ceilings. Refer to Section 098400 Acoustic Room Components.

C. Acoustical Insulation - Safing Insulation.
   1. Safing insulation should be 4-5 lb/ft3 density unfaced semi-rigid fiberglass or mineral wool material. Thickness as called out on the drawings or as required to fully pack voids. Safing insulation should be dimensionally stable and should not slump within cavity. Safing insulation should be inorganic, rot, mildew and vermin proof and should not corrode steel, copper and aluminum. Flame spread and smoke developed index not to exceed 25 and 50 respectively per ASTM E-84.
   2. The following are acceptable, subject to the above:
      a. Safing Insulation or Mineral Wool from Owens Corning Fiberglas Corporation, Toledo, OH. (800) 438-7465
      b. Pyro Fiber Safing from Johns Manville Mechanical Insulation Division, Denver, CO. (800) 654-3103

D. Acoustical Insulation - Sound Absorptive Material for Acoustical Ceilings, Floating Floors and Penetrations.
   1. Sound absorptive material for above acoustical ceilings, under floating floors and for around penetrations in walls and floor/ceiling assemblies shall be fiberglass or mineral

fiber with a density of 1-1/2 lb/ft3. Thickness shall be as called out on the drawings. It shall be unfaced and supplied in semi-rigid board form. Flame spread and smoke developed index not to exceed 25, per ASTM E-84. Material shall be non-combustible per ASTM E136. Where large penetrations occur in fire-rated constructions, the use of semi-rigid fire-rated mineral wool safing may be required.

2. Material to be laid directly on upper side of sound control ceiling, or between vibration isolation supports in floating floor constructions. For use in sealing penetrations of acoustically-rated partitions, pack material completely in space between penetrating object and partition, leaving no voids or spaces.
3. The following are acceptable, subject to the above:
   a. Industrial Insulation Type 701 unfaced, from Owens Corning Fiberglas Corporation, Toledo, OH. (800) 438-7465
   b. Insul-Shield 150 from Johns Manville, Denver, CO. (800) 654-3103
   c. Insulation Board from Knauf Fiber Glass GmbH, Shelbyville, IN. (317) 398-4434

2.02 ACCESSORIES

A. Insulation Impaling Fasteners:
   1. Impaling pins consisting of metal spindle with perforated base plate for adhesive application.
   2. Spun aluminum friction fit retainer caps.
   3. Select length to suit insulation thickness so insulation is depressed same thickness for visual uniformity.
   4. Adhesive: As recommended by impaling pin manufacturer for project substrates and insulation thickness.
   5. Retainer Caps:
      a. RC 10 washers and “Dome Cap Washer” matching Architect’s sample by AGM (Western Welding Systems; 1.800.287.9873).
      b. Dome Cap, Gemco.
      c. Paint caps and washers flat black unless otherwise indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

3.02 INSTALLATION

A. Install acoustical insulation plumb, level, in proper alignment.

B. Anchor components securely in place after proper alignment.

C. Scribe insulation to fit adjacent work.

D. Butt joints tightly.

E. Apply accessories and concealed fastenings as recommended by manufacturer.

F. Impaling Pins at Exposed Insulation:
   1. Adhere impaling pins to clean, dry sound substrates with recommended adhesive.
   2. Locate impaling pins in pattern indicated on Drawings. Provide symmetrical layout on visually acceptable grid.

3. Layout insulation so joints align in both directions; provide insulation panels of same size and symmetrically located within wall or ceiling area.
4. Supplement ceiling impaling pins with spray adhesive to hold horizontally mounted insulation.
5. Cut insulation panels with sharp knife to achieve clean-cut edges.
6. Do not use small pieces of insulation where single piece will fit.
7. Impale insulation panels onto spindle with edges tightly butted.
8. Install retainer caps over spindle without over-compressing insulation.
9. Touch-up painted caps with paint to match insulation; flat black or white.

G. Remove and replace panels which have been damaged and are unacceptable to Architect.

3.03 ADJUSTING

A. Adjust installed panels to ensure ends and edges of adjacent panels are flush and in alignment with each other, unless otherwise indicated.

3.04 CLEANING

A. Clean finished surfaces and accessories in accordance with manufacturer's directions.

B. Cover or otherwise protect installed work to prevent soiling.

C. Clean and repair surfaces soiled or otherwise damaged in connection with work of this Section. Pay cost of replacing finishes or materials that cannot be satisfactorily cleaned or which have been damaged by improper cleaning materials and techniques.

END OF SECTION

SECTION 09 84 00
ACOUSTIC ROOM COMPONENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fabric-covered fiberglass core panels and mounting accessories.

B. Pyramid Shaped Ceiling Diffusers.

1.02 RELATED REQUIREMENTS

A. Section 01 74 19 – Construction Waste Management.

B. Section 01 81 13 – Sustainable Design Requirements.

C. Section 01 81 19 – Indoor Air Quality Requirements.

D. Section 06 10 00 - Rough Carpentry

E. Section 06 20 00 - Finish Carpentry

F. Section 09 51 00 - Acoustical Ceilings

G. Section 09 90 00 - Paints and Coatings

1.03 LEED REQUIREMENTS

A. LEED Focus Materials (LFMs) For This Section:
   1. Targeted products containing Recycled Content (MRc4)
   2. Targeted products containing Regional Material (MRc5)

1.04 SUBMITTALS

A. Product Data: Manufacturer's printed data sheets for products specified.
   1. Provide manufacturer's product specifications and installation instructions for acoustical panels and attachment system. Include manufacturer's recommendations for cleaning the fabric on all the acoustical panels, including precautions against materials and methods that may be detrimental to finishes and acoustical performance.

B. Shop Drawings: Fabrication and installation details, panel layout, and fabric orientation. Shop drawings shall indicate at large scale, all locations of acoustical panels. Submit profiles, sizes and reinforcing and anchorage devices, for securing to adjacent materials.

C. Submit certificate of compliance to specified acoustical and fire performance criteria, signed by an officer of the panel manufacturer and attach independent laboratory test results for each product used, showing that the products supplied as components and complete assemblies, meet or exceed the specified requirements.

D. Selection Samples: Manufacturer's color charts for fabric covering, indicating full range of fabrics, colors, and patterns available.

E. Verification Samples: Fabricated samples of each type of panel specified; 24 by 24 inch, showing construction, edge details, and fabric covering, with exposed color and texture and mounting clip and trim to be expected in completed work.

F. Submit samples of all different types of mounting devices, extrusions, etc. for use in this project.

G. Test Reports: Certified test data from an independent test agency verifying that panels meet specified requirements for acoustical and fire performance.

H. LEED Product and Material Data Summary Form: For all installed products and materials of this Section, complete the “LEED Product and Material Data Summary Form” (attached to end of Section 01 81 13 - Sustainable Design Requirements)
   1. Product Material Cost: Provide the cost for material, or an assembled product, including taxes and delivery but excluding any cost for labor and equipment required for installation after the material is delivered to the site.
   2. Product Data for Credit MRc4, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating cost for each product having recycled content.
   3. Product Data for Credit MRc5, Regional Material: For products having regional materials, documentation indicating location of raw material extraction, harvest or recovery, as well as, manufacture (location of final assembly) within 500 miles of project site. Include statement indicating cost for each material or component of the assembled product.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company with not less than 5 years of experience in manufacturing acoustical products similar to those specified.

B. Installation by firm with not less than three years of successful experience in installation of acoustical panels similar to requirements for this project. The installing contractor shall shall have a written document signed by the manufacturer verifying manufacturer's approval of the referenced contractor to install the acoustical products that are the responsibilty of that contractor.

C. Provide acoustical panels which have been tested, rated and labeled by U.L. for indicated ratings as listed in "Classification Building Materials Index" by U.L.
   1. Fire Performance Characteristics: Provide acoustic wall panels with surface-burning characteristics as determined by testing panel components in accordance with ASTM E84 test procedures
      a. ASTM E-84 Classification Class "A" or "1"
      b. Flame Spread: 25 or less
      c. Smoke Developed: 450 or less

D. Acoustical Performance Characteristics: Provide acoustic wall panels with acoustical absorption characteristics as indicated in Part 2, which have been determined by testing fully assembled production material in accordance with ASTM C 423 (Type "A" mounting as defined by ASTM E-795) by a testing organization acceptable to authorities having jurisdiction.

E. All fabric finishes specified for acoustic panels shall be tested in accordance with ASTM D6207 - Standard Test Method for Dimensional Stability of Fabrics to Changes in Humidity and Temperature

F. All acoustical wall and ceiling panels of the same type shall be purchased from a single supplier.

G. Sustainability and LEED Standards Certification:
   1. Regional manufactured products with percentage by weight.
   2. Recycled content calculated as 1/2 preconsumer + postconsumer.

3. VOC content limitations defined in Section 018114, "Volatile Organic Compound (VOC) Limits For Adhesives, Sealants, Paints, and Coatings."

1.06 WARRANTY

A. Written guarantee that panels are constructed in accordance with the acoustical laboratory tested product and will be free of defects in material and workmanship for a period of one year after installation.

B. Provide warranty above for a period of five years for acoustic room components.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect acoustical panels from moisture during shipment, storage, and handling. Deliver in factory-wrapped bundles; do not open bundles until panels are needed for installation, cartoned or crated to provide protection during transit and job storage, properly tagged and identified.

B. Inspect acoustical panels upon delivery for damage. Minor damages may be repaired provided refurbished items are equal in all respects to new work and acceptable to Architect; otherwise, remove and replace damaged items as directed.

C. Store panels flat, in dry, well-ventilated space; do not stand panels on end. Protect products from damage that may be caused by exposure to water, moisture, chemicals, direct sunlight, or infestation.

D. Protect panel edges from damage. On site storage shall be such as to assure that all panels and associated materials are protected from damage, and storage area is climatically controlled to normal operational levels.

E. Comply with manufacturer's recommendations.

1.08 PROJECT CONDITIONS

A. Project Environmental Requirements: Prior to unpacking or installing, ensure that the installation area is fully enclosed and protected from moisture and direct sunlight. Ensure that the building's mechanical systems are fully operational and will not be turned off again even for testing and balancing of the mechanical systems. Coordinate with other trades to ensure that all work above or behind surfaces is complete and that all wet and dusty trades have completed work.

B. Product Acclimatization: If recommended by manufacturer, allow both the installation area and the components to stabilize in temperature and humidity levels that are representative of the final temperature and humidity levels expected after building completion and occupation following manufacturer's instructions. Do not install products if the humidity exceeds 65%.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fabric-Covered Acoustical Panels:
   1. Basis of Design: Conwed Design Scape, Ladysmith, WI 800-932-2383 www.conweddesignscape.com.
   2. Golterman & Sabo, ATF Acousti-Tack Fiberglass. www.gsacoustics.com
   3. Armstrong World Industries, Inc., Lancaster, PA 717-397-0611 www.armstrong.com
   4. Acoustical Absorptive AP Panel by Decoustics Limited, www.decoustics.com, P.O. Box 615, Getzville, NY,14068-0615 (800)387-3809

5. Kinetics Noise Control, Interiors Division, Dublin, OH 614-889-0480 www.kineticsnoise.com
6. Metal Building Interiors, Cleveland, OH 216-431-6400 www.mbiproducts.com
7. AVL Systems, Inc., 5540 SW 6th Place, Ocala, FL 34474: www.AVLonline.com

B. Pyramid Ceiling Sound Diffuser Panels:
1. Basis of Design: Pyramid Ceiling Diffuser Panels by Acoustical Solutions Inc., 2420 Grenoble Road, Richmond, VA 23294 804-346-8350 www.acousticalsolutions.com
2. Kinetics Noise Control, Interiors Division, Dublin, OH 614-889-0480 www.kineticsnoise.com
3. RPG Diffuser Systems, Inc., 651-C Commerce Drive, Upper Marlboro, MD 20774 301-249-0044 www.rpginc.com
4. AVL Systems, Inc., 5540 SW 6th Place, Ocala, FL 34474: www.AVLonline.com

2.02 FABRIC-COVERED ACOUSTICAL PANELS

A. Materials, Glass Fiber Core Panels:
1. IR Series, Conwed Design; 2 inch thickness,unless otherwise noted.
2. Glass-fiber board core, 6 to 7 lb/cu. ft. density.
3. Tackable, impact-resistant, high-density face layer: 1/8 inch thick layer molded glass-fiberboard with min. density of 16 to 18 lb/cu. ft.
4. Edges: Beveled.
5. Fabric; Guilford of Maine.

B. Materials, Glass Fiber Core Panels - Performing Arts Center:
1. Decoustics Type AP Fabric-Covered Panels.
2. Edges shall be chemically hardened to withstand moderate impact during installation and ongoing maintenance. Chemically hardened edges will be profiled as shown on the architectural drawings.
3. The panel shall be constructed of 6 to 7 lb./cu.ft (96 to 112 kg/cu.m.) density acoustically absorptive core of 1" (25mm), 1 ½" (38mm), 2" (50mm), 3" (75mm), or 4" (100mm) thickness, and finished as detailed in this section, as indicated, and scheduled. Panels shall be tackable.
4. Core shall be free of surface defects and sanded as required to a uniform thickness, which will not vary by more than +/- 0.03" (1.0mm).
5. Panel core dimensions shall be accurate to a tolerance of +/- 0.06" (1.6mm).
6. Fabric finish shall be bonded to or stretch applied over the panel face, bonded to the panel edges and returned a minimum of one inch (25mm) on the back of the panel. The finish shall be flat and wrinkle free and fully tailored at corners with no exposed darting. All finishes shall be tested for suitability (ASTM D6207) and approved for use by the panel manufacturer prior to procurement and fabrication.
7. Acoustical performance: Noise Reduction Coefficient (NRC): Per the below table when tested in accordance with ASTM C423 for Type A mounting, per ASTM E795. Panels shall have noise reduction coefficient values of the following when tested using an acoustically transparent fabric.

Panel			Frequency (Hz)							
Type	Thickness	Finish	125	250	500	1000	2000	4000	NRC	SAA
AP	1" (25mm)	Fabric	0.03	0.37	0.89	1.10	1.09	1.05	0.85	0.87
AP	1 1/2" (38mm)	Fabric	0.15	0.58	1.01	1.13	1.1	1.03	0.95	N/A
AP	2" (50mm)	Fabric	0.23	0.81	1.19	1.19	1.11	1.12	1.05	1.07

AP	3" (75mm)	Fabric	0.73	0.88	1.06	1.12	1.08	1.02	1.05	1.05
AP	4" (100mm)	Fabric	0.55	1.0	1.19	1.24	1.17	1.13	1.15	1.15

8. Mounting: Installation shall be either by use of slide and engage clips (“Z”- clips), either into a DWC-7 anti-rattle wall clip or into continuous wall track. Panel clips (DPC-3) and wall clips (DWC-7 or continuous wall track)) shall be a minimum 20 gauge satin-coat steel with wall clips mechanically mounted to the back of the panels. All fasteners (wall anchors, screws, adhesive, etc.) are to be supplied by the installing contractor.
9. Finish: Fabric Covering: Seamless fabric facing material, for stretched covering of core material, selected by Architect.
    a. Patterns: Where fabric with directional or repeating patterns or fabric with directional weave is used, mark for installation in same direction.

C. Materials, Expanded Metal Mesh Fabric Covered Acoustic Panels - Studio Theater:
1. Basis of Design: Acoustical Absorptive AP Panel by Decoustics Limited, with wrapping of woven wire mesh: “1/2” Square Opening” pattern, Plain Steel Cold Rolled by McNichols.
    a. a. NRC 0.70 for 1” panels and NRC 0.90 for 2” panels, minimum
    b. b. Location: Partial coverage of Studio Theater sidewalls.

2.03 PYRAMID CEILING SOUND DIFFUSER PANELS

A. Materials:
1. One-piece rigid E-glass
2. Panel Shape and Size: As indicated on drawings
3. Mounting: Suitable for support by heavy-duty T-bar ceiling suspension system.

B. Finish: Painted finish from manufactures standard range.

C. Location: Music, Choral, and Band rooms.

2.04 FABRICATION OF FABRIC-COVERED ACOUSTICAL PANELS

A. Fabric Wrapped, General: Fabricate panels to sizes and configurations indicated, with fabric facing installed without sagging, wrinkles, blisters, or visible seams.
1. For panels suspended from ceiling, provide fabric covering both sides, with seams only at panel edges.

B. Tolerances: Fabricate to finished tolerance of plus or minus 1/16 inch (1.6 mm) for thickness, overall length and width, and squareness from corner to corner.

2.05 ACCESSORIES

A. Fabric Wrapped and Cementitious Wood Fiber Acoustical Wall Units:
1. Back-Mounting Accessories: Manufacturer's standard accessories for concealed support for each panel type, designed to allow panel removal, and as follows:
    a. Two-part clip and base-support bracket or rail system; brackets or rails designed to support full weight of panels and clips designed for lateral support, with one part mechanically attached to back of panel and the other attached to substrate.
    b. If the above is not available for a specific panel, metal impaling clips designed to support full weight of panels, mechanically attached to substrate and adhesively bonded to back of panels.
    c. In all cases mounting systems are to be concealed and approved by manufacturer for proper performance.

2. Ceiling Suspension Accessories: Manufacturer's standard through-threaded eyelets bolted through concealed perimeter frame at 1/4 points on each panel, sized appropriately for weight of panels.
   a. Provide galvanized wire for suspension from ceiling at heights indicated.

B. Diffuser and Wood Fiber Panels
1. Manufacturer's standard accessories for concealed support for each panel type, designed to allow panel removal; fixing clips, furring strips, brackets, or rails as standard for manufacturer's concealed mounting systems.
   a. In all cases mounting systems are to be concealed and approved by manufacturer for proper performance.
2. Ceiling Suspension Accessories: For panels supported from ceiling suspension grids, and accessories required for manufacturer's standard concealed mounting method.
   a. Provide additional galvanized wire of vertical members to support additional weight of panels, as required.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates for conditions detrimental to installation of acoustical panels. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Panels shall be allowed to stabilize on site 24 hours prior to installation.

C. Protection: Protect all floor, wall and ceiling finishes against possible damage prior to commencing installation and during installation.

D. Do not install acoustical panels until space is enclosed and weather-proof, wet-work in space is completed and dry work above ceilings is completed and until ambient conditions of temperature and humidity will be continuously maintained at values near those indicated for final occupancy.

E. Coordinate with Other Work: Support all light fixtures, HVAC air inlet/outlet devices, speakers, signage, sprinkler heads/piping, etc. independently from panels. Contractor shall not use panels to support the weight of any other building element or component.

3.02 INSTALLATION

A. General:
1. Installation shall be in accordance with local code requirements, manufacturers instructions, and as shown on approved shop drawings, or detail sheets. Installer shall provide for shimming and adjustments as required to maintain consistent alignment of joints and of finished panel faces, and to ensure unstressed clip and mounting locations.
2. Installation shall be by factory-trained personnel or manufacturer's representatives.

B. Mounting Prefabricated Wood Fiber Acoustical Panels or Diffuser Panels:
1. Panels must only be handled by persons who are equipped as recommended by manufacturer including provisions for wearing clean light-weight gloves.
2. Install acoustical panels in locations indicated, following installation recommendations of panel manufacturer. Align panels accurately, with edges plumb and top edges level. Scribe to fit accurately at adjoining work and penetrations. Finished surfaces are to be mounted on the exposed side.
3. Lay ceiling diffuser panels in ceiling suspension grid specified under Section 09 5100 in accordance with provisions of that Section and and per panel manufacturer's instructions and recommendations.

C. Install panels and diffusers to construction tolerances of plus or minus 1/16 inch (1.6 mm) for the following:
   1. Plumb and level.
   2. Flatness.
   3. Width of joints.

3.03 ADJUSTING

A. Following initial installation, adjust mounting hardware or suspension system so that removable panels can be removed easily, yet stay safely secured upon replacement. Adjust panels so that surfaces are aligned, flush and level or plumb and gaps in between units are of a consistent width and straight.

3.04 CLEANING

A. Clean fabric facing or other surface upon completion of installation from dust and other foreign materials, following manufacturer's instructions.

B. Remove surplus materials, trimmed portions of panels, and debris resulting from installation.

3.05 PROTECTION

A. Provide protection of installed acoustical panels until completion of the work.

B. Replace panels that cannot be cleaned and repaired to satisfaction of the Architect.

C. After installation, protect planks against dirt, water, changes in humidity and contact.

3.06 DEMONSTRATION

A. Demonstrate to the building owner or to the owner’s representative the safe and proper method for removing and replacing all types of accessible panels.

B. Supply the building owner or the owner’s representative with any special tools provided by the manufacturer required to unlatch safety hardware on accessible panels.

END OF SECTION

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SECTION 09 91 13
EXTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Surfaces to be finished are indicated in this section and on the Drawings.

D. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
   1. Exposed surfaces of steel lintels and ledge angles.

E. Do Not Paint or Finish the Following Items:
   1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
   5. Stainless steel, anodized aluminum.
   6. Marble, limestone, granite, slate, and other natural stones (UON).
   7. Floors, unless specifically indicated.
   8. Brick, architectural concrete, cast stone, integrally colored plaster and stucco (UON).
   9. Exterior insulation and finish system (EIFS).
   10. Glass.
   11. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

A. Section 01 74 19 – Construction Waste Management.

B. Section 01 81 13 – Sustainable Design Requirements.

C. Section 01 81 14 – Volatile Organic Compound (VOC) Limits For Adhesives, Sealants, Paints & Coatings.

D. Section 01 81 19 – Indoor Air Quality Requirements.

E. Section 05 50 00 - Metal Fabrications: Shop-primed items.

F. Section 09 91 23 - Interior Painting.

1.03 DEFINITIONS

A. Conform to ASTM D16 for interpretation of terms used in this section.

1.04 REFERENCE STANDARDS

A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2016.

B. SSPC-SP 1 - Solvent Cleaning; 2015.

C. SSPC-SP 2 - Hand Tool Cleaning; 1982 (Ed. 2004).

D. SSPC-SP 6 - Commercial Blast Cleaning; 2007.

1.05 LEED REQUIREMENTS

A. LEED Focus Materials (LFMs) For This Section:
   1. Targeted products containing Recycled Content (MRc4)
   2. Targeted products containing Regional Material (MRc5)
   3. Targeted products to meet VOC requirements (EQc4.1 & EQc4.2)

1.06 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
   2. Cross-reference to specified paint system(s) product is to be used in; include description of each system.

C. Samples: Submit two paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
   1. Where sheen is specified, submit samples in only that sheen.

D. Certification: By manufacturer that paints and finishes comply with VOC limits specified.

E. Maintenance Data: Submit data including product technical data sheets and material safety data sheets (MSDS).

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
   3. Label each container with color in addition to the manufacturer's label.

G. LEED Product and Material Data Summary Form: For all installed products and materials of this Section, complete the “LEED Product and Material Data Summary Form” (attached to end of Section 01 81 13 - Sustainable Design Requirements)
   1. Product Material Cost: Provide the cost for material, or an assembled product, including taxes and delivery but excluding any cost for labor and equipment required for installation after the material is delivered to the site.
   2. Product Data for Credit MRc4, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating cost for each product having recycled content.
   3. Product Data for Credit MRc5, Regional Material: For products having regional materials, documentation indicating location of raw material extraction, harvest or recovery, as well as, manufacture (location of final assembly) within 500 miles of project site. Include statement indicating cost for each material or component of the assembled product.
   4. Product Data for Credit EQc4.2, Paints & Coatings: For paints and coatings, documentation including printed statement of VOC content and chemical components.

1.07 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the type of work specified with minimum five years documented experience.

B. Sustainability and LEED Standards Certification:
   1. Regional manufactured products with percentage by weight.
   2. Recycled content calculated as 1/2 preconsumer + postconsumer.
   3. VOC content limitations defined in Section 018114, "Volatile Organic Compound (VOC) Limits For Adhesives, Sealants, Paints, and Coatings."

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.09 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

D. Minimum Application Temperatures for Latex Paints: 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.

B. Provide paints and finishes from the same manufacturer to the greatest extent possible.
   1. In the event that a single manufacturer cannot provide specified products, minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.

C. Paints: Acceptable manufacturers are limited to the following:
   1. Sherwin-Williams Company: www.sherwin-williams.com.
   2. Benjamin Moore & Co: www.benjaminmoore.com.
   3. Glidden Professional: www.gliddenprofessional.com.

D. Primer Sealers: Same manufacturer as top coats.

E. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready mixed, unless required to be a field-catalyzed paint.

1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
3. Supply each paint material in quantity required to complete entire project's work from a single production run.
4. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Volatile Organic Compound (VOC) Content: Comply with Section 01 81 14.

C. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

D. Colors: To be selected from manufacturer's full range of available colors.
1. Selection to be made by Architect after award of contract.
2. Allow for minimum of five colors for each system, unless otherwise indicated, without additional cost to Owner.
3. Extend colors to surface edges; colors may change at any edge as directed by Architect.

E. Provide Premium Grade systems (2 top coats).

2.03 PAINT SYSTEMS - EXTERIOR

A. SYSTEM E-1:
1. Substrate: Structural Steel and Metal Fabrications:
2. Applications include but are not limited to primed miscellaneous metal and structural steel.
3. Manufacturers and products:
a. Sherwin Williams:
1) 1st Coat: S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series
2) 2nd Coat: S-W A-100 Exterior Latex Gloss, A8 Series
3) 3rd Coat: S-W A-100 Exterior Latex Gloss, A8 Series
b. Benjamin Moore:
1) 1st Coat: Moore PO6 Super Spec HP Alkyd Metal Primer
2) 2nd Coat: 096 MoorGlo Acrylic Semi-Gloss House Paint
3) 3rd Coat: 096 MoorGlo Acrylic Semi-Gloss House Paint
c. Glidden Professional:
1) 1st Coat: Devoe Coatings DEVFLEX Direct-to-Metal 4020 primer
2) 2nd Coat: Glidden Professional Fortis 450 6407 topcoat
3) 3rd Coat: Glidden Professional Fortis 450 6407 topcoat

B. SYSTEM E-2:
1. Substrate: Hollow metal door frames:
2. Finish: Semi-Gloss.
3. Manufacturers and Products:
a. Sherwin Williams:
1) 1st Coat: DTM Acrylic Primer/Finish, B66W1
2) 2nd Coat: Pro Industrial High Performance Acrylic Coating, B66W00651
3) 3rd Coat: Pro Industrial High Performance Acrylic Coating, B66W00651

b. Benjamin Moore:
1) 1st Coat: Moorcraft Super Spec DTM Alkyd Satin, Z163
2) 2nd Coat:Moorcraft Super Spec Urethane Gloss Enamel, Z22
3) 3rd Coat: Moorcraft Super Spec Urethane Gloss Enamel, Z22

C. SYSTEM E-3:
1. Substrate: Galvanized Metal, Not Chromate Passivated:
2. Applications include but are not limited to railings, lintels and bollards.
3. Manufacturers and Products:
a. Sherwin Williams:
1) 1st Coat:S-W Pro Industrial Pro-Cryl® Primer, B66-310 Series
2) 2nd Coat:S-W ProMar® 200 Latex Semi-Gloss, B31W2200 Series
3) 3rd Coat:S-W ProMar® 200 Latex Semi-Gloss, B31W2200 Series
b. Benjamin Moore:
1) 1st Coat: Moore P04 Super Spec HP Acrylic Metal Primer
2) 2nd Coat:Moore N096 MoorGlo Acrylic Semi-Gloss House Paint
3) 3rd Coat:Moore N096 MoorGlo Acrylic Semi-Gloss House Paint

D. SYSTEM E-4:
1. Substrate: Aluminum
2. Applications include existing window frames, existing storefront framing.
3. Manufacturers and Products:
a. Carboline Company:
1) 1st Coat: Carbothane 133 LH or Carbothane 133 LV: tint to finish color.
2) 2nd Coat: Carboxane 950 VOC
3) 3rd Coat: Carboxane 950 VOC
b. Sherwin Williams:
1) 1st Coat:S-W DTM Bonding Primer
2) 2nd Coat:S-W BondPlex Acrylic
3) 3rd Coat:S-W BondPlex Acrylic

E. Paint E-OP - Exterior Surfaces to be Painted, Unless Otherwise Indicated: Including concrete, concrete masonry units, brick, and Plaster/Stucco.
1. Two top coats and one coat primer.
2. Top Coat(s): Exterior Light Industrial Coating, Water Based.
a. Products:
1) Sherwin-Williams ProIndustrial DTM Acrylic, semi-gloss.
3. Top Coat Sheen:
a. Eggshell: MPI gloss level 3; use this sheen for concrete, masonry and plaster substrates, as scheduled.
b. Semi-Gloss: MPI gloss level 5; use this sheen for steel and wood substrates, as scheduled.

2.04 PRIMERS

A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
1. Alkali Resistant Water Based Primer.
a. Products:

1) Sherwin-Williams Loxon Concrete & Masonry Primer/Sealer.

2. Interior/Exterior Latex Block Filler.
   a. Products:
      1) Sherwin-Williams Pro Industrial Heavy Duty Block Filler.
3. Water Based Primer for Galvanized Metal.
   a. Products:
      1) Sherwin-Williams Pro Industrial Pro-Cryl Universal Primer.
4. Bonding Primer, Water Based.
   a. Products:
      1) Sherwin-Williams Extreme Bond Primer.

2.05 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been properly prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.

D. Test shop-applied primer for compatibility with subsequent cover materials.

E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
   1. Exterior Plaster and Stucco: 12 percent.
   2. Masonry, Concrete, and Concrete Masonry Units: 12 percent.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.

D. Seal surfaces that might cause bleed through or staining of topcoat.

E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

F. Concrete:

G. Masonry:
   1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
   2. Prepare surface as recommended by top coat manufacturer.

H. Exterior Plaster: Fill hairline cracks, small holes, and imperfections with exterior patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

I. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

J. Galvanized Surfaces:
   1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
   2. Prepare surface according to SSPC-SP 2.

K. Ferrous Metal:
   1. Solvent clean according to SSPC-SP 1.
   2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.
   3. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

L. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

A. Paint all exposed surfaces except where indicated not to be painted or to remain natural; the term "exposed" includes areas visible through permanent and built-in fixtures when they are in place.
   1. Paint surfaces behind movable equipment and furnishings the same as similar exposed surfaces.

B. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

C. Paint surfaces to be concealed behind permanently installed fixtures, equipment, and furnishings, using primer only, prior to installation of the permanent item.

D. Paint back sides of access panels and removable and hinged covers to match exposed surfaces.

E. Finish top, bottom, and side edges of exterior doors the same as exposed faces.

F. Paint all insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment occurring in finished areas to match background surfaces, unless otherwise indicated.

G. Apply products in accordance with manufacturer's instructions using the preparation, products, sheens, textures, and colors as indicated.
   1. Remove, refinish, or repaint work not complying with requirements.

H. Use applicators and methods best suited for substrate and type of material being applied and according to manufacturer's instructions.

I. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate; provide total dry film thickness of entire system as recommended by manufacturer.
   1. Number of coats and film thickness required are the same regardless of application method.

2. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance.
3. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive dry film thickness equivalent to that of flat surfaces.

J. Apply finish to completely cover surfaces with uniform appearance without brush marks, runs, sags, laps, ropiness, holidays, spotting, cloudiness, or other surface imperfections.
1. Before applying finish coats, apply a prime coat of material recommended by manufacturer, unless the surface has been prime coated by others; where evidence of suction spots or unsealed areas in first coat appear, recoat primed and sealed surfaces to ensure finish coat with no burn through or other defects due to insufficient sealing.
2. Apply first coat to surface that has been cleaned, pretreated, or otherwise prepared as soon as practical after preparation and before subsequent surface deterioration.
3. Do not apply succeeding coats until the previous coat has cured as recommended by manufacturer.
4. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of another coat will not cause the undercoat to lift or lose adhesion.
5. If manufacturer's instructions recommend sanding to produce a smooth, even surface, sand between coats.
6. Before applying next coat vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
7. Pigmented (Opaque) Finishes: Provide smooth, opaque surface of uniform finish, color, appearance, and coverage.

K. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply additional coats until complete hide is achieved.

L. Sand wood and metal surfaces lightly between coats to achieve required finish.

M. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.05 PROTECTION

A. Protect other work, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting as approved by Architect.

B. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.

C. Protect finishes until completion of project.

D. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 09 91 23
INTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Field applied primers are in addition to shop primers.

D. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
   1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
   2. Elevator pit ladders.
   3. Prime surfaces to receive wall coverings.
   4. Mechanical and Electrical:
      a. In finished areas, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
      b. In finished areas, paint shop-primed items.
      c. Paint interior surfaces of air ducts and convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.
      d. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.

E. Do Not Paint or Finish the Following Items:
   1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
   5. Stainless steel, anodized aluminum, bronze, terne coated stainless steel, and lead items.
   6. Marble, granite, slate, and other natural stones.
   7. Floors, unless specifically indicated.
   8. Ceramic and other tiles.
   9. Brick, architectural concrete, cast stone, integrally colored plaster and stucco.
   10. Glass.
   11. Acoustical materials, unless specifically indicated.
   12. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

A. Section 01 74 19 – Construction Waste Management.

B. Section 01 81 13 – Sustainable Design Requirements.

C. Section 01 81 14 – Volatile Organic Compound (VOC) Limits For Adhesives, Sealants, Paints & Coatings.

D. Section 01 81 19 – Indoor Air Quality Requirements.

E. Section 05 50 00 - Metal Fabrications: Shop-primed items.

F. Section 05 51 00 - Metal Stairs: Shop-primed items.

G. Section 09 91 13 - Exterior Painting.

1.03 DEFINITIONS

A. Conform to ASTM D16 for interpretation of terms used in this section.

1.04 REFERENCE STANDARDS

A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2016.

B. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2016.

C. SSPC-SP 1 - Solvent Cleaning; 2015.

D. SSPC-SP 2 - Hand Tool Cleaning; 1982 (Ed. 2004).

E. SSPC-SP 6 - Commercial Blast Cleaning; 2007.

1.05 LEED REQUIREMENTS

A. LEED Focus Materials (LFMs) For This Section:
   1. Targeted products containing Recycled Content (MRc4)
   2. Targeted products containing Regional Material (MRc5)
   3. Targeted products to meet VOC requirements (EQc4.1 & EQc4.2)

1.06 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
   2. Cross-reference to specified paint system(s) product is to be used in; include description of each system.

C. Samples: Submit two paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
   1. Where sheen is specified, submit samples in only that sheen.
   2. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens definitely not required.

D. Certification: By manufacturer that paints and finishes comply with VOC limits specified.

E. Manufacturer's Instructions: Indicate special surface preparation procedures.

F. Maintenance Data: Submit data including product technical data sheets and material safety data sheets (MSDS).

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.

2. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
3. Label each container with color in addition to the manufacturer's label.

H. LEED Product and Material Data Summary Form: For all installed products and materials of this Section, complete the “LEED Product and Material Data Summary Form” (attached to end of Section 01 81 13 - Sustainable Design Requirements)
1. Product Material Cost: Provide the cost for material, or an assembled product, including taxes and delivery but excluding any cost for labor and equipment required for installation after the material is delivered to the site.
2. Product Data for Credit MRc4, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating cost for each product having recycled content.
3. Product Data for Credit MRc5, Regional Material: For products having regional materials, documentation indicating location of raw material extraction, harvest or recovery, as well as, manufacture (location of final assembly) within 500 miles of project site. Include statement indicating cost for each material or component of the assembled product.
4. Product Data for Credit EQc4.2, Paints & Coatings: For paints and coatings, documentation including printed statement of VOC content and chemical components.

1.07 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the type of work specified with minimum five years documented experience.

B. Sustainability and LEED Standards Certification:
1. Regional manufactured products with percentage by weight.
2. Recycled content calculated as 1/2 preconsumer + postconsumer.
3. VOC content limitations defined in Section 018114, "Volatile Organic Compound (VOC) Limits For Adhesives, Sealants, Paints, and Coatings."

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.09 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply materials when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F above the dew point; or to damp or wet surfaces.

D. Minimum Application Temperatures for Paints: 50 degrees F for interiors unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.

B. Provide paints and finishes from the same manufacturer to the greatest extent possible.
   1. In the event that a single manufacturer cannot provide specified products, minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.

C. Paints and Coatings:
   1. Sherwin-Williams Company: www.sherwin-williams.com.
   2. Benjamin Moore: www.benjaminmoore.com.
   3. Glidden Professional: www.gliddenprofessional.com.

D. Primer Sealers: Same manufacturer as top coats.

E. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready mixed, unless intended to be a field-catalyzed paint.
   1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
   2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
   3. Supply each paint material in quantity required to complete entire project's work from a single production run.
   4. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Volatile Organic Compound (VOC) Content: Comply with Section 01 81 14.

C. Flammability: Comply with applicable code for surface burning characteristics.

D. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

E. Colors: As indicated on drawings.
   1. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling they are mounted on/under.

F. Provide Premium Grade systems (2 top coats).

2.03 PAINT SYSTEMS - INTERIOR

A. SYSTEM I-1:
   1. Substrate: Concrete Masonry Units
   2. Manufacturers and Products:
      a. Sherwin Williams:
         1) 1st Coat:S-W PrepRite® Block Filler, B25W25

2) 2nd Coat:S-W ProMar® 200 Latex Semi-Gloss, B20W2200 Series
3) 3rd Coat:S-W ProMar® 200 Latex Semi-Gloss, B20W2200 Series

b. Benjamin Moore:
1) 1st Coat:Moore 160 Super Spec Latex Block Filler
2) 2nd Coat:333 Regal AquaGlo Acrylic Semi-Gloss Enamel
3) 3rd Coat:333 Regal AquaGlo Acrylic Semi-Gloss Enamel

c. Glidden Professional:
1) 1st Coat:Glidden Professional Block Filler 3010 primer
2) 2nd Coat:Glidden Professional Diamond 450 7400 topcoat
3) 3rd Coat:Glidden Professional Diamond 450 7400 topcoat

B. SYSTEM I-2
1. Substrate: Concrete Masonry Units (Epoxy paint, Semi-gloss finish)
2. Manufacturers and Products:
a. Sherwin Williams:
1) 1st Coat:S-W Heavy Duty Block Filler, B42W46
2) 2nd Coat:S-W Pro Industrial HB/ Waterbased Epoxy, B71W111/B71W100 Series
3) 3rd Coat:S-W Pro Industrial HB/ Waterbased Epoxy, B71W111/B71W100 Series

b. Benjamin Moore:
1) 1st Coat: Super Spec HP Waterborne Epoxy Block Filler P31
2) 2nd Coat:Super Spec HP Acrylic Epoxy Coating P43
3) 3rd Coat:Super Spec HP Acrylic Epoxy Coating P43

C. SYSTEM I-3
1. Substrate: Structural Steel and Metal Fabrications:
2. FInish: Semi-Gloss.
3. Manufacturers and Products:
a. Sherwin Williams:
1) 1st Coat: S-W Pro Industrial Pro-Cryl® Primer, B66-310 Series
2) 2nd Coat: S-W ProMar® 200 Latex Semi-Gloss, B31W2200 Series
3) 3rd Coat: S-W ProMar® 200 Latex Semi-Gloss, B31W2200 Series

b. Benjamin Moore:
1) 1st Coat: Moore P04 Super Spec HP Acrylic Metal Primer
2) 2nd Coat:N333 Regal AquaGlo Acrylic Semi-Gloss Enamel
3) 3rd Coat: N333 Regal AquaGlo Acrylic Semi-Gloss Enamel

D. SYSTEM I-4
1. Substrate: Hollow metal doors and frames:
2. Finish: Semi-Gloss.
3. Manufacturers and Products:
a. Sherwin Williams:
1) 1st Coat: DTM Acrylic Primer/Finish, B66W1
2) 2nd Coat: Pro Industrial High Performance Acrylic Coating, B66W00651
3) 3rd Coat: Pro Industrial High Performance Acrylic Coating, B66W00651

b. Benjamin Moore:

1) 1st Coat: Corotech Acrylic Metal Primer V110.
2) 2nd Coat:Corotech Acrylic DTM Enamel Semi-Gloss V331.
3) 3rd Coat: Corotech Acrylic DTM Enamel Semi-Gloss V331.

E. SYSTEM I-5
1. Substrate: Galvanized Metal, Not Chromate Passivated:
2. Applications include but are not limited to exposed ductwork.
3. Manufacturers and Products:
a. Sherwin WIlliams:
1) 1st Coat:S-W Pro Industrial Pro-Cryl® Primer, B66-310 Series
2) 2nd Coat:S-W ProMar® 200 Latex Semi-Gloss, B31W2200 Series
3) 3rd Coat:S-W ProMar® 200 Latex Semi-Gloss, B31W2200 Series
b. Benjamin Moore:
1) 1st Coat: Moore P04 Super Spec HP Acrylic Metal Primer
2) 2nd Coat:N333 Regal AquaGlo Acrylic Semi-Gloss Enamel
3) 3rd Coat:N333 Regal AquaGlo Acrylic Semi-Gloss Enamel

F. SYSTEM I-6
1. Substrate: Woodwork (Opaque Semi-Gloss Finish)
2. Manufacturers and Products:
a. Sherwin Williams:
1) 1st Coat: S-W Premium Wall & Wood Primer, B28W8111
2) 2nd Coat: S-W Pro Industrial 0 VOC Semi-Gloss Acrylic B66W651 Series
3) 3rd Coat: S-W Pro Industrial 0 VOC Semi-Gloss Acrylic B66W651 Series
b. Benjamin Moore:
1) 1st Coat: Moore 023 Fresh Start 100 percent Acrylic Primer Sealer
2) 2nd Coat:N333 Regal Acrylic Latex Semi-Gloss Enamel
3) 3rd Coat: N333 Regal Acrylic Latex Semi-Gloss Enamel
c. Glidden Professional:
1) 1st Coat: Glidden Professional High Hide 1000 primer
2) 2nd Coat:Glidden Professional Diamond 450 7400 topcoat
3) 3rd Coat:Glidden Professional Diamond 450 7400 topcoat

G. SYSTEM I-7
1. Substrate: Gypsum Board (Eggshell Finish):
2. Applications include ceilings, soffits, and bulkheads.
3. Manufacturers and Products:
a. Sherwin Williams:
1) 1st Coat:S-W PrepRite 200 Int. Latex Primer, B28 Series
2) 2nd Coat:S-W ProMar® 200 Latex Eggshell, B20Series
3) 3rd Coat:S-W ProMar® 200 Latex Eggshell, B20Series
b. Benjamin Moore:
1) 1st Coat: Moore P04 Super Spec HP Acrylic Metal Primer
2) 2nd Coat:N319 Regal Acrylic Latex Eggshell Finish Enamel
3) 3rd Coat:N319 Regal Acrylic Latex Eggshell Finish Enamel
c. Glidden Professional:
1) 1st Coat: Glidden Professional High Hide 1000 primer
2) 2nd Coat:Glidden Professional Diamond 450 7300 topcoat
3) 3rd Coat:Glidden Professional Diamond 450 7300 topcoat

H. SYSTEM I-8
   1. Substrate: Gypsum Board (Epoxy Finish):
   2. Applications include walls in custodial, mechanical areas, kitchens, and as indicated.
   3. Manufacturers and Products:
      a. Sherwin Williams:
         1) 1st Coat:PrepRite 200 Int Latex Primer
         2) 2nd Coat:ProIndustrial Precat. WB Epoxy, Eggshell, Series K45
         3) 3rd Coat:ProIndustrial Precat. WB Epoxy, Eggshell, Series K45
      b. Benjamin Moore:
         1) 1st Coat: Benjamin Moore Ultra Spec 500 Interior Latex Primer N534
         2) 2nd Coat: Corotech Pre-Catalyzed Waterborne Epoxy Eggshell V342
         3) 3rd Coat: Corotech Pre-Catalyzed Waterborne Epoxy Eggshell V342
      c. Glidden Professional:
         1) 1st Coat: Glidden Professional High Hide 1000 primer
         2) 2nd Coat: Devoe Coatings TRU-GLAZE WB Epoxy 4426 topcoat
         3) 3rd Coat: Devoe Coatings TRU-GLAZE WB Epoxy 4426 topcoat

I. SYSTEM I-9
   1. Substrate: Concrete Floor (Sealed):
   2. Manufacturers and Products:
      a. W. R. Meadows:
         1) 1st Coat:CS-309/30 Concrete Curing and Sealing Compound

2.04 PRIMERS

A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
   1. Interior/Exterior Latex Block Filler.
      a. Products:
         1) Sherwin-Williams PrepRite® Block Filler, B25W25.
         2) Corotech Acrylic Block Filler V114
   2. Interior Drywall Primer Sealer.
      a. Products:
         1) Sherwin-Williams ProMar Latex 200 Primer .
         2) Benjamin Moore Ultra Spec 500 Interior Latex Primer N534
   3. Interior Rust-Inhibitive Water Based Primer.
      a. Products:
         1) Sherwin-Williams Pro Industrial Pro-Cryl® Primer, B66-310 Series.
         2) Corotech Prep All Universal Metal Primer V132
   4. Bonding Primer, Water Based.
      a. Products:
         1) Sherwin-Williams Extrem Bond Primer.
         2) Benjamin Moore Super Spec HP Acrylic Metal Primer P04

2.05 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been properly prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.

D. Test shop-applied primer for compatibility with subsequent cover materials.

E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
   1. Gypsum Wallboard: 12 percent.
   2. Interior Wood: 15 percent, measured in accordance with ASTM D4442.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or repair existing paints or finishes that exhibit surface defects.

D. Remove surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

E. Seal surfaces that might cause bleed through or staining of topcoat.

F. Remove mildew from impervious surfaces by scrubbing with solution of water and bleach. Rinse with clean water and allow surface to dry.

G. Masonry:
   1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
   2. Prepare surface as recommended by top coat manufacturer.

H. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.

I. Galvanized Surfaces:
   1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
   2. Prepare surface according to SSPC-SP 2.

J. Ferrous Metal:
   1. Solvent clean according to SSPC-SP 1.
   2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces.
   3. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

K. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

L. Wood Surfaces to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats. Prime concealed surfaces with gloss varnish reduced 25 percent with thinner.

M. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.03 APPLICATION

A. Paint all exposed surfaces except where indicated not to be painted or to remain natural; the term "exposed" includes areas visible through permanent and built-in fixtures when they are in place.
   1. Paint surfaces behind movable equipment and furnishings the same as similar exposed surfaces.

B. Paint surfaces to be concealed behind permanently installed fixtures, equipment, and furnishings, using primer only, prior to installation of the permanent item.

C. Paint back sides of access panels and removable and hinged covers to match exposed surfaces.

D. Finish top, bottom, and side edges of exterior doors the same as exposed faces.

E. Paint all insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment occurring in finished areas to match background surfaces, unless otherwise indicated.

F. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

G. Apply products in accordance with manufacturer's written instructions using the preparation, products, sheens, textures, and colors as indicated.

H. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

I. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

J. Apply each coat to uniform appearance in thicknesses specified by manufacturer.

K. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply as many coats as necessary for complete hide.

L. Sand wood and metal surfaces lightly between coats to achieve required finish.

M. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

N. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

O. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.04 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for general requirements for field inspection.

3.05 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.06 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 09 93 00
REFINISHING WOOD FLOORING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The general provisions of the Contract, including the Conditions of the Contract (General, Supplementary and other Conditions, if any) and Division 1 as appropriate, apply to the Work specified in this Section.

1.02 SECTION INCLUDES

A. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 01011, SUMMARY OF WORK. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. This Section includes the following:
   1. Sanding and refinishing of solid-wood strip or plank flooring.
   2. Sanding and refinishing of solid-wood strip or plank gym flooring.
   3. Game lines and color logos in gymnasiums.
   4. Brass cover plates at abandoned penetrations.

1.03 SUBMITTALS

A. Product Data: Submit for each product to be used. Include fillers and primers.
   1. Material List: Provide an inclusive list of required materials. Indicate each material and cross-reference specific finish system and application.
   2. Manufacturer's Information: Provide manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.
   3. Certification by the manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).

B. Gym Floor Refinishing Products: Submit certification that floor seal/finish to be provided has been approved by the Maple Flooring Manufacturer’s Association.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed wood flooring similar in material, design, and extent to that indicated for this Project and whose work has resulted in wood flooring installations with a record of successful in-service performance.

B. Source Limitations: Obtain each type of material and product from one source with resources to provide materials and products of consistent quality in appearance and physical properties.

C. Sample Room: Request review of first finished room for color, appearance, and workmanship. Approved room shall serve as the standard of quality for the project.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:
   1. Product name or title of material.
   2. Product description (generic classification or binder type).
   3. Manufacturer's stock number and date of manufacture.

4. Contents by volume, for pigment and vehicle constituents.
5. Thinning instructions.
6. Application instructions.
7. Color name and number.
8. VOC content.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain containers used in storage in a clean condition, free of foreign materials and residue.

C. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

1.06 PROJECT CONDITIONS

A. Conditioning: Maintain relative humidity planned for building occupants and an ambient temperature between 65 and 75 deg F in spaces to receive wood flooring for at least seven days before re-finishing. After re-finishing, maintain relative humidity and ambient temperature planned for building occupants.
   1. Close spaces to traffic during flooring re-finishing and for time period after re-finishing recommended in writing by finish manufacturers.

B. Apply water-based finishes only when the temperature of surfaces to be finished and surrounding air temperatures are between 50 and 90 deg F.

C. Apply solvent-thinned finishes only when the temperature of surfaces to be finished and surrounding air temperatures are between 45 and 95 deg F.

PART 2 PRODUCTS

2.01 FINISHING MATERIALS

A. Urethane Finish System: Complete system of compatible components that is recommended by finish manufacturer for application indicated.
   1. Type: Solvent based, oil modified, or water based may be used.
   2. Stain: Penetrating and non fading type.
   3. Color: As selected by Architect from manufacturer's full range.
   4. Floor Sealer: Pliable, penetrating type.
   5. Finish Coats: Formulated for multi coat application on wood flooring.

B. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Basic Coatings.
   2. BonaKemi USA, Inc.
   3. Dura Seal Division; Minwax Co., Inc.
   4. Hillyard Floor Treatments.
   5. Huntington Laboratories, Inc.
   6. National Coatings Co.

C. Wood Filler: Formulated to fill and repair seams, defects, and open-grain hardwood floors; compatible with finish system components and recommended by filler and finish manufacturers for use indicated. If required to match approved samples, provide pigmented filler.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine wood flooring areas and condition for compliance with requirements, tolerances, and other conditions affecting performance of wood flooring. Proceed with re-finishing only after unsatisfactory conditions have been corrected.

3.02 SANDING AND FINISHING

A. Machine-sand flooring to remove offsets, ridges, cups, and sanding-machine marks that would be noticeable after finishing. Vacuum and tack with a clean cloth immediately before applying finish.

B. Apply filler according to manufacturer's written instructions. Fill open-grained hardwood. Fill and repair seams and defects.

C. Apply stain to match approved sample if required.

D. Apply floor sealer according to finish manufacturer's written instructions.

E. Game lines:
   1. Provide game lines for up to four (4) games and three (3)-color logo up to 6’ in diameter to be specified by Architect.
   2. Apply game marking using paint that is compatible with the chosen sealer and finish.

F. Apply floor finish according to finish manufacturer's written instructions. Apply in number of coats recommended by finish manufacturer for application indicated, but not less than the number of coats indicated on drawings and schedule at the end of this Section.

G. For water-based finishes, use finishing methods recommended by finish manufacturer to minimize grain raise.

H. Provide solid brass cover plates at abandoned piping and electrical penetrations.

3.03 PROTECTION

A. Cover installed wood flooring to protect it from damage or deterioration, before and after finishing, during remainder of construction period. Use heavy Kraft-paper or other suitable covering. Do not use plastic sheet or film that could cause condensation.
   1. Do not cover site-finished floors with Kraft paper, or any other material, until finish reaches full cure, but not less than seven days after applying last coat.

3.04 SCHEDULE

A. The following levels are provided to establish the contract requirements for wood floor refinishing work. Refer to drawings for locations:
   1. Level 1: Clean and fine sand (screen) floors. Apply one (1) finish coat.
   2. Level 2: Completely sand floors to remove existing finish to bare wood. Stain and seal to match approved sample. Apply three (3) finish coats.

END OF SECTION

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SECTION 10 11 01
VISUAL DISPLAY BOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Markerboards and Tackboards.

1.02 RELATED REQUIREMENTS

A. Section 01 74 19 – Construction Waste Management.

B. Section 01 81 13 – Sustainable Design Requirements.

C. Section 01 81 19 – Indoor Air Quality Requirements.

D. Section 06 10 00 - Rough Carpentry: Blocking and supports.

E. Section 09 21 16 - Gypsum Board Assemblies: Concealed supports in metal stud walls.

1.03 REFERENCE STANDARDS

1.04 LEED REQUIREMENTS

A. LEED Focus Materials (LFMs) For This Section:
   1. Targeted products containing Recycled Content (MRc4)
   2. Targeted products containing Regional Material (MRc5)
   3. Targeted products to meet VOC requirements (EQc4.1 & EQc4.2)
   4. Targeted products to meet Composite Wood & Agrifiber requirements (EQc4.4)

1.05 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Product Data: Provide manufacturer's data on markerboard, tackboard, tackboard surface covering, trim, and accessories.

C. Shop Drawings: Indicate wall elevations, dimensions, joint locations, special anchor details.

D. Samples: Submit two samples 2 by 2 inch in size illustrating materials and finish, color and texture of markerboard, tackboard, tackboard surfacing, and trim.

E. Test Reports: Show conformance to specified surface burning characteristics requirements.

F. Manufacturer's printed installation instructions.

G. LEED Product and Material Data Summary Form: For all installed products and materials of this Section, complete the “LEED Product and Material Data Summary Form” (attached to end of Section 01 81 13 - Sustainable Design Requirements)
   1. Product Material Cost: Provide the cost for material, or an assembled product, including taxes and delivery but excluding any cost for labor and equipment required for installation after the material is delivered to the site.
   2. Product Data for Credit MRc4, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating cost for each product having recycled content.
   3. Product Data for Credit MRc5, Regional Material: For products having regional materials, documentation indicating location of raw material extraction, harvest or recovery, as well as, manufacture (location of final assembly) within 500 miles of project

site. Include statement indicating cost for each material or component of the assembled product.

4. Product Data for Credit EQc4.4, Composite Wood & Agrifiber Products: Product data sheets, MSDS, certificates or letter from product manufacture highlighting that the composite wood or agrifiber product and/or associated laminating adhesive do not contain urea-formaldehyde resin.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Sustainability and LEED Standards Certification:
   1. Regional manufactured products with percentage by weight.
   2. Recycled content calculated as 1/2 preconsumer + postconsumer.
   3. No Added Urea Formaldehyde in product.

1.07 WARRANTY

A. See Section 01 77 00 - Closeout Procedures, for additional warranty requirements.

B. Provide five year warranty for markerboard to include warranty against discoloration due to cleaning, crazing or cracking, and staining.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Visual Display Boards:
   1. Claridge Products and Equipment, Inc: www.claridgeproducts.com.
   2. MooreCo, Inc: www.moorecoinc.com.
   3. Polyvision Corporation (Nelson Adams): www.polyvision.com.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 VISUAL DISPLAY BOARDS

A. Markerboards: Porcelain enamel on steel, laminated to core.
   1. Basis of Design: Polyvision 500 series P3 CeramicSteel boards
   2. Color: White.
   3. Steel Face Sheet Thickness: 24 gage, 0.0239 inch .
   4. Core: Particleboard, manufacturer's standard thickness, laminated to face sheet.
   5. Backing: Aluminum sheet, laminated to core.
   6. Size: As indicated on drawings.
   7. Frame: Extruded aluminum, with concealed fasteners.
   8. Frame Finish: Anodized, natural.
   9. Accessories: Provide chalk tray and map rail.

B. Tackboards: Fine-grained, homogeneous natural cork.
   1. Cork Thickness: 1/8 inch.
   2. Backing: Hardboard, 1/4 inch thick, laminated to tack surface.
   3. Size: As indicated on drawings.
   4. Frame: Same type and finish as for markerboard.

C. Special Boards:
   1. Pre-printed boards:
      a. Markerboard with staff lines
         1) Location: As shown on plans

2.03 ART HANGING AND DISPLAY SYSTEM

A. Corridor Hanging & Display Rails
   1. Basis of Design: Casso EDU Display Rail by AS Hanging Systems Corp.
   2. Material: Extruded aluminum track, extruded co-polymer gripper insert
   3. Finish: Silver Satin
   4. Length: 6 foot rails, extendable on both ends in a continuous installation
   5. Mounting Height: As indicated on drawings
   6. Location: As indicated on drawings
   7. Substitutions: See Section 01 60 00 - Product Requirements.

2.04 ACCESSORIES

A. Map Rail: Extruded aluminum, manufacturer's standard profile, with cork insert and runners for accessories; 1 inch wide overall, full width of frame.

B. Temporary Protective Cover: Sheet polyethylene, 8 mil thick.

C. Flag Holders: 1 per classroom, plus additional 12 units. Aluminum wall bracket, fits up to 1/4 inch to 5/8 inch diameter staff

D. Mounting Brackets: Concealed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that internal wall blocking is ready to receive work and positioning dimensions are as indicated on shop drawings.

3.02 INSTALLATION

A. Install boards in accordance with manufacturer's instructions.

B. Secure units level and plumb.

3.03 CLEANING

A. Clean board surfaces in accordance with manufacturer's instructions.

B. Cover with protective cover, taped to frame.

C. Remove temporary protective cover at Date of Substantial Completion.

END OF SECTION

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SECTION 10 21 13
PLASTIC TOILET COMPARTMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Solid plastic toilet compartments.

B. Urinal screens.

1.02 RELATED REQUIREMENTS

A. Section 01 74 19 – Construction Waste Management.

B. Section 01 81 13 – Sustainable Design Requirements.

C. Section 01 81 19 – Indoor Air Quality Requirements

D. Section 10 28 00 - Toilet, Bath, and Laundry Accessories.

1.03 REFERENCE STANDARDS

A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

B. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2015.

1.04 LEED REQUIREMENTS

A. LEED Focus Materials (LFMs) For This Section:
   1. Targeted products containing Recycled Content (MRc4)
   2. Targeted products containing Regional Material (MRc5)
   3. Targeted products to meet VOC requirements (EQc4.1 & EQc4.2)

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the work with placement of support framing and anchors in walls and ceilings.

1.06 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Product Data: Provide data on panel construction, hardware, and accessories.

C. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings.

D. Samples: Submit two samples of partition panels, 6 by 6 inch in size illustrating panel finish, color, and sheen.

E. LEED Product and Material Data Summary Form: For all installed products and materials of this Section, complete the “LEED Product and Material Data Summary Form” (attached to end of Section 01 81 13 - Sustainable Design Requirements)
   1. Product Material Cost: Provide the cost for material, or an assembled product, including taxes and delivery but excluding any cost for labor and equipment required for installation after the material is delivered to the site.
   2. Product Data for Credit MRc4, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer

recycled content. Include statement indicating cost for each product having recycled content.

3. Product Data for Credit MRc5, Regional Material: For products having regional materials, documentation indicating location of raw material extraction, harvest or recovery, as well as, manufacture (location of final assembly) within 500 miles of project site. Include statement indicating cost for each material or component of the assembled product.

1.07 QUALITY ASSURANCE

A. Sustainability and LEED Standards Certification:
   1. Regional manufactured products with percentage by weight.
   2. Recycled content calculated as 1/2 preconsumer + postconsumer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Solid Plastic Toilet Compartments:
   1. Accurate Partitions Corporation.
   2. Ampco Products, Inc: www.ampco.com.
   3. Compression Polymers Group; Comtec Industries
   4. ASI Global Partitions
   5. Metpar Corp: www.metpar.com.
   6. Scranton Products (Santana/Comtec/Capital): www.scrantonproducts.com.

2.02 SOLID PLASTIC TOILET COMPARTMENTS

A. Toilet Compartments: Factory fabricated doors, pilasters, and divider panels made of solid molded high density polyethylene (HDPE), tested in accordance with NFPA 286, floor-mounted headrail-braced.

B. Doors:
   1. Thickness: 1 inch.
   2. Width: 24 inch.
   3. Width for Handicapped Use: 36 inch, out-swinging.
   4. Height: 55 inch.

C. Panels:
   1. Thickness: 1 inch.
   2. Height: 55 inch.

D. Pilasters:
   1. Thickness: 1 inch.
   2. Width: As required to fit space; minimum 3 inch.

E. Screens: Without doors; to match compartments; mounted to wall with two panel brackets.

2.03 ACCESSORIES

A. Pilaster Shoes: Formed ASTM A666, Type 304 stainless steel with No. 4 finish, 3 inch high, concealing floor fastenings.

B. Head Rails: Hollow anodized aluminum, 1 inch by 1-1/2 inch size, with anti-grip profile and cast socket wall brackets.

C. Pilaster Brackets: Polished stainless steel.

D. Wall Brackets: Continuous type, polished stainless steel.

E. Attachments, Screws, and Bolts: Stainless steel, tamper proof type.

F. Hardware: Polished stainless steel:
   1. Pivot hinges, gravity type, adjustable for door close positioning; two per door.
   2. Door Latch: Slide type with exterior emergency access feature.
   3. Door strike and keeper with rubber bumper; mounted on pilaster in alignment with door latch.
   4. Coat hook with rubber bumper; one per compartment, mounted on door.
   5. Provide door pull for outswinging doors.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated on shop drawings.

B. Verify correct spacing of and between plumbing fixtures.

C. Verify correct location of built-in framing, anchorage, and bracing.

3.02 INSTALLATION

A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.

B. Maintain 3/8 inch to 1/2 inch space between wall and panels and between wall and end pilasters.

C. Attach panel brackets securely to walls using anchor devices.

D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.

3.03 ADJUSTING

A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.

B. Adjust hinges to position doors in partial opening position when unlatched. Return out-swinging doors to closed position.

END OF SECTION

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SECTION 10 22 39
FOLDING PANEL PARTITIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Top-supported folding panel partitions, horizontal opening.

B. Acoustic operable panel partition.

C. Ceiling track and operating hardware.

D. Pocket Door

1.02 RELATED REQUIREMENTS

A. Section 01 74 19 – Construction Waste Management.

B. Section 01 81 13 – Sustainable Design Requirements.

C. Section 01 81 19 – Indoor Air Quality Requirements.

D. Section 05 12 00 - Structural Steel Framing: Overhead track structural support framing.

1.03 REFERENCE STANDARDS

A. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).

B. ASTM E413 - Classification for Rating Sound Insulation; 2016.

C. ASTM E557 - Standard Guide for Architectural Design and Installation Practices for Sound Isolation between Spaces Separated by Operable Partitions; 2012.

1.04 LEED REQUIREMENTS

A. LEED Focus Materials (LFMs) For This Section:
   1. Targeted products containing Recycled Content (MRc4)
   2. Targeted products containing Regional Material (MRc5)

1.05 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Product Data: Provide data on partition materials, operation, hardware and accessories, electric operating components, and track switching components.

C. Shop Drawings: Indicate opening sizes, track layout, details of track and required supports, static and dynamic loads, location and details of pass door and frame, adjacent construction and finish trim, and stacking depth.

D. Samples for Review: Submit two samples of surface finish, 12 by 12 inches size, illustrating quality and colors selected.

E. Manufacturer's Instructions: Indicate special procedures.

F. Certificates: Certify that partition system meets or exceeds specified acoustic requirements.

G. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods. Describe cleaning materials detrimental to finish surfaces and hardware finish.

H. LEED Product and Material Data Summary Form: For all installed products and materials of this Section, complete the "LEED Product and Material Data Summary Form" (attached to end of Section 01 81 13 - Sustainable Design Requirements)
   1. Product Material Cost: Provide the cost for material, or an assembled product, including taxes and delivery but excluding any cost for labor and equipment required for installation after the material is delivered to the site.
   2. Product Data for Credit MRc4, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating cost for each product having recycled content.
   3. Product Data for Credit MRc5, Regional Material: For products having regional materials, documentation indicating location of raw material extraction, harvest or recovery, as well as, manufacture (location of final assembly) within 500 miles of project site. Include statement indicating cost for each material or component of the assembled product.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

C. Preparation of the opening shall conform to the criteria set forth per ASTM E557 Standard Practice for Architectural Application and Installation of Operable Partitions

D. Sustainability and LEED Standards Certification:
   1. Regional manufactured products with percentage by weight.
   2. Recycled content calculated as 1/2 preconsumer + postconsumer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until installation.

1.08 WARRANTY

A. See Section 01 77 00 - Closeout Procedures, for additional warranty requirements.

B. Provide two year manufacturer warranty against defects in material and workmanship, excluding abuse.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Design is based on Hufcor,Inc.; Product Series 633E.

B. Other Acceptable Manufacturers:
   1. Modernfold, Inc: www.modernfold.com.
   2. Panelfold, Inc: www.panelfold.com.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 FOLDING PANEL PARTITIONS - HORIZONTAL OPENING

A. Folding Panel Partitions: Center opening; continuous hinged panels; center stacking; motor operated.

B. Performance:
   1. Acoustic Performance:

a. Sound Transmission Class (STC): 51 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90, on panel size of 100 sq ft.

2. Installed partition system track capable of supporting imposed loads, with maximum deflection of 1/360 of span.

C. Accessories:

1. Pocket Enclosures: Door, frame, and trim to match adjacent walls.
2. Acoustic Sealant: As recommended by partition manufacturer.

2.03 MATERIALS

A. Product to be top supported electrically operated, continuously hinged panels.

1. Panels shall be nominally 3 inches thick, to 48 inches in width, and continuously hinged.
2. Panel faces shall be laminated to appropriate substrate to meet the STC requirement.
3. Frames shall be of 16 gauge painted steel with integral factory applied aluminum vertical edge and face protection.
4. Vertical sound seals shall be of tongue and groove configuration, ensure panel-to-panel alignment and prevent sound leaks between panels.
5. Horizontal top seals shall be fixed continuous contact dual 4-finger vinyl.
6. All standard panels shall have bottom retractable seals which provide a minimum of 2 inches floor clearance during movement of the partition, including all panels adjacent to pass door(s). Retractable bottom floor seal to exert downward seal force when activated. Floating or rigid seals that maintain contact with the floor during partition movement will not be acceptable.
7. Panels must provide wall-to-wall contact for tight acoustical seal. Operable wall systems that do not extend to the back of storage pocket are not acceptable.

B. Weight of the panels shall be 5.7-10.2 lbs. per sq. ft. based on options selected.

C. Suspension system

1. Track shall be of clear anodized architectural grade extruded aluminum alloy 6063-T6. Track design shall provide precise alignment at the trolley running surfaces and provide integral support for adjoining ceiling, soffit, or plenum sound barrier. Guide rails and/or track sweep seals shall not be required. Track shall be connected to the structural support by pairs of minimum. 3/8 inch diameter threaded steel hanger rods.
   a. Each panel shall be supported by one 4-wheeled carrier in the track and one internal 4-wheeled carrier. Wheels to be of hardened steel ball bearings encased with molded polymer tires.
2. Factory assembled power unit shall be UL listed and include motor, electronic torque limiter, two key control stations wired in series, emergency release, and all necessary equipment for electric operation. Roller chain drive shall attach to carrier of lead panel. Limit switches shall be provided to prevent over-travel. Motor shall be able to operate 50-60 hz., and 200-240 volts, single phase with adequate horsepower to operate partition effectively.
3. Safety Requirements:
   a. Low profile hinges shall be of steel and project no more than 1/4 inch beyond panel faces. Panels to have a minimum of three hinges.
   b. Each panel must be supported by a single carrier allowing the panels to stack freely without the use of rub rails near the pocket, thus decreasing the risk of injury while stacking into a pocket.

c. Partition shall be operated by two (2) control stations wired in series and located on opposite sides and ends of the partition. The key stations require human contact to be activated ensuring supervised operation of the partition system.

D. Finishes
1. Face finish: Markerboard and high pressure laminate to be selected by manufacturer's full range (factory installed on trimmed models). Markerboard surface from 2'-8" to 7'-0" above floor, high pressure laminate surface above and below, both sides.
2. Exposed metal trim and seal color shall be selected by manufacturer's standard range.
3. Aluminum track shall be clear anodized

E. Safety system which automatically stops the partition's forward movement when an object or person contacts the lead edge of the partition during movement.

F. Pocket Door
1. Pocket door finish: High Pressure Laminate
2. Pocket doors allow the operable wall to extend to the back wall of the pocket for optimum acoustics. Both doors (leaves) swing outward or inward. A narrow flipper panel completes pocket closure when doors are closed.
3. When used with electrically operated operable walls, pocket doors are equipped with limit switches. To prevent damage to the pocket doors, the limit switches will not allow the partition to operate until the pocket doors are completely open.

2.04 OPERATION

A. Partitions shall be key switch controlled, requiring constant contact to activate the motor. As a safety precaution, two key switches are required to activate the partition. Switches to be mounted on both sides of partition to provide operators a clear view of the partition path to prevent injury.

B. Motor drive shall automatically seal the partition in the opening. For models with retractable bottom seals, the motor automatically sets the bottom seals.

C. Stack/Store Panels
1. Panels are retracted and stored by activating the two key-switch controls.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify track supports are laterally braced and will permit track to be level within 1/4 inch of required position and parallel to the floor surface.

C. Verify floor flatness of 1/8 inch in 10 feet, non-cumulative.

D. Verify wall plumbness of 1/8 inch in 10 feet, non-cumulative.

3.02 INSTALLATION

A. Install partition in accordance with manufacturer's instructions and ASTM E557.

B. Lubricate moving components.

C. Install acoustic sealant to achieve required acoustic performance.

D. Coordinate electrical connections.

3.03 ADJUSTING

A. Adjust partition assembly to provide smooth operation from stacked to full open position. Do not over-compress acoustic seals.

B. Visually inspect partition in full extended position for light leaks to identify a potential acoustical leak.

C. Adjust partition assembly to achieve lightproof seal.

3.04 CLEANING

A. Clean finish surfaces and partition accessories.

3.05 CLOSEOUT ACTIVITIES

A. Demonstrate operation of partition and identify potential operational problems.

END OF SECTION

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SECTION 10 22 41
OPERABLE GLASS PARTITIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Operable glass partitions, manually operated.

1.02 RELATED REQUIREMENTS

A. Section 01 74 19 – Construction Waste Management.

B. Section 01 81 13 – Sustainable Design Requirements.

C. Section 01 81 19 – Indoor Air Quality Requirements.

D. Section 05 12 00 - Structural Steel Framing: Overhead track structural support framing.

E. Section 08 71 00 - Door Hardware: Mortise cylinders.

1.03 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).

B. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2013.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene at project site seven calendar days prior to scheduled beginning of construction activities of this section to review section requirements.

1.05 LEED REQUIREMENTS

A. LEED Focus Materials (LFMs) For This Section:
   1. Targeted products containing Recycled Content (MRc4)
   2. Targeted products containing Regional Material (MRc5)

1.06 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Product Data: Manufacturer's descriptive literature for each component in partition assembly.

C. Shop Drawings: Drawings showing layout, dimensions, identification of components, and interface with adjacent construction.
   1. Include field measurements of openings.
      a. Field Measurements: Contractor to field verify dimensions of rough openings and threshold depressions to receive sill. Mark field measurements on shop drawing submittal.
   2. Include details of:
      a. Requirements for support and bracing of overhead track.
      b. Installation details.
      c. Appearance of manufacturer-supplied door hardware and fittings.

D. Verification Samples: Two samples, minimum size 2 by 3 inches, representing actual material and finish of exposed metal.

E. Certificates: Contractor to certify that installer of partition assemblies meets specified qualifications.

F. Operation and Maintenance Data: For manufacturer-supplied operating hardware.

G. Manufacturer's Installation Instructions: Include complete preparation, installation, and cleaning requirements.

H. LEED Product and Material Data Summary Form: For all installed products and materials of this Section, complete the "LEED Product and Material Data Summary Form" (attached to end of Section 01 81 13 - Sustainable Design Requirements)
   1. Product Material Cost: Provide the cost for material, or an assembled product, including taxes and delivery but excluding any cost for labor and equipment required for installation after the material is delivered to the site.
   2. Product Data for Credit MRc4, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating cost for each product having recycled content.
   3. Product Data for Credit MRc5, Regional Material: For products having regional materials, documentation indicating location of raw material extraction, harvest or recovery, as well as, manufacture (location of final assembly) within 500 miles of project site. Include statement indicating cost for each material or component of the assembled product.

1.07 QUALITY ASSURANCE

A. Fabricator Qualifications: Minimum three years of experience designing, assembling, and installing partition assemblies similar to those specified in this section.

B. Preparation of the opening shall conform to the criteria set forth per ASTM E557 Standard Practice for Architectural Application and Installation of Operable Partitions

C. Sustainability and LEED Standards Certification:
   1. Regional manufactured products with percentage by weight.
   2. Recycled content calculated as 1/2 preconsumer + postconsumer.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to job site in sealed, unopened cartons or crates.
   1. Upon receipt, inspect the shipment to ensure it is complete, in good condition and meets project requirements.

B. Store material under cover in a clean and dry location, protecting units against weather and defacement or damage from construction activities, especially to the edges of panels.

1.09 WARRANTY

A. See Section 01 77 00 - Closeout Procedures, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Provide five year manufacturer warranty against excessive degradation of metal finishes. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS

2.01 BASIS OF DESIGN

A. Basis-of-Design Product: NanaWall SL45 by NANA WALL SYSTEMS, INC. (www.nanawall.com)

B. Other Manufacturers: Provide either the product identified as "Basis of Design" or an equivalent product of another manufacturer.
   1. C.R. Laurence Company, Inc: www.crl-arch.com/sle.
   2. Modernfold, a DORMA Group Company: www.modernfold.com.
   3. Hufcor, Inc; www.hufcor.com/#sle..

C. Substitutions: See Section 01 60 00 - Product Requirements.

D. Design Criteria:
   1. Sizes and Configurations: As indicated by the Drawings for selected number and size of panels, location of swing panels, and location of tracks and stacking bays.
   2. Unit Operation: Adjustable sliding and folding hardware with top and bottom tracks;
      a. Inswing Type
   3. Panel Configuration: Straight
   4. Stack Storage Configuration: Inside
   5. Mounting Type: Top hung
   6. Panel Type: Hinged
      a. Primary swing panel of paired swing panels, looking from inside, to be on the left.
      b. Entry/Egress panel hinged to side jamb.
   7. Panel Pairing Configuration: Standard Configuration, equal number of panels on each side of opening.

2.02 MATERIALS

A. Sliding-Folding Glass Storefront Description: Monumental top-hung system designed for straight runs, segmented angle changes, center pivot, and capable of folding flat against adjacent walls. Manufacturer's standard frame and panel profiles, with head and floor tracks, side jambs and panels with dimensions as shown on Drawings.
   1. Panels:
      a. Single lite.
   2. Panel Size (W x H): As indicated.
   3. Rail Depth: 1-3/4 inch
   4. Head Width: 4-7/8 inch
   5. Head and Jamb Rail Width: 2-1/8 inch
   6. Bottom Rail Width:
      a. 2-1/16 inch for Flush Sill
   7. Aluminum Extrusion: AIMgSi0.5 alloy, 6063-T5
   8. Aluminum Finish (including head track covers): Clear anodized.

B. Glass and Glazing:
   1. Safety Glazing: In compliance with ANSI Z97.1 and CPSC 16CFR 1201.
   2. Glass: 1/4 inch single, laminated glass w/ sound enhanced interlayer
   3. STC: 37 minimum

C. Locking Hardware and Handles:
   1. Main Entry Panelfor Models with Swing Panel: Provide manufacturer's standard lever handles on the inside and outside and a lockset with a lockable latch and multi-point locking with a dead bolt and rods at the top and bottom on primary panel only.
      a. Rods to be concealed and not edge mounted.
      b. After turn of key or thumbturn, depression of handles withdraws latch.

c. Lifting of handles engages rods and turn of key or thumb turn engages deadbolt and operates lock.
d. Lever Handle - Finish: Brushed Stainless Steel
e. Locking: Adapter for Small Format Interchangeable Core (SFIC)

2. Main Entry Panel For Models with a Swing Panel: Provide lever handles on the inside and outside with single action, emergency egress, interconnected lock.

D. Sliding- Folding Hardware: Provide manufacturer's standard combination sliding and folding hardware with top and bottom tracks.

1. Sliding- Folding Hardware: Provide manufacturer's standard combination sliding and folding hardware with top and bottom tracks.
   a. For each pair of folding panels, provide independent cardanic suspension for four (4) wheeled rollers coated with fiberglass reinforced polyamide upper running carriage and lower guide carriage.
2. Swing Panel Hinges:
   a. Zinc die cast with finish closest match to finish of frame and panels and stainless steel security hinge pins with set-screws.
3. Adjustment: Provide 1/16 inch in width per hinge adjustments without removing panels from tracks and without needing to remove panels from tracks.
4. Sill Type: Flush sill, not thermally broken
   a. Finish: Aluminum, Clear Anodized

E. Fasteners: Stainless steel screws for connecting frame components.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify track supports are laterally braced and will permit track to be level within 1/4 inch of required position and parallel to the floor surface.

C. Verify floor flatness of 1/8 inch in 10 feet, non-cumulative.

D. Do not begin installation until supports and adjacent substrates have been properly prepared.

E. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean substrates thoroughly prior to installation.

B. Prepare substrates using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install in accordance with track and fitting manufacturer's instructions.

B. Fit and align partition assembly and pocket doors level and plumb.

3.04 ADJUSTING

A. Adjust partition to operate smoothly from stacked to fully extended position.

B. Adjust swing door hardware for smooth operation.

3.05 CLEANING

A. Thoroughly clean surfaces and materials installed as part of this work.

3.06 CLOSEOUT ACTIVITIES

A. Demonstrate operation of partition and identify potential operational problems.

3.07 PROTECTION

A. Keep units closed and protect Folding Glass Storefront installation against damage from construction activities.

B. Remove protective coatings and use manufacturer recommended methods to clean exposed surfaces.

C. Protect installed products and materials until Date of Substantial Completion.

D. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

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SECTION 10 26 00
WALL AND DOOR PROTECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Corner guards.

B. Protective wall covering.

C. Fiberglass reinforced wall panels.

1.02 RELATED REQUIREMENTS

A. Section 01 74 19 – Construction Waste Management.

B. Section 01 81 13 – Sustainable Design Requirements.

C. Section 01 81 19 – Indoor Air Quality Requirements.

1.03 REFERENCE STANDARDS

A. ASTM D543 - Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents; 2014.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.

1.04 LEED REQUIREMENTS

A. LEED Focus Materials (LFMs) For This Section:
   1. Targeted products containing Recycled Content (MRc4)
   2. Targeted products containing Regional Material (MRc5)

1.05 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Product Data: Indicate physical dimensions, features, and accessories.

C. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

D. Maintenance Data: For each type of product . Include information regarding recommended and potentially detrimental cleaning materials and methods.

E. LEED Product and Material Data Summary Form: For all installed products and materials of this Section, complete the “LEED Product and Material Data Summary Form” (attached to end of Section 01 81 13 - Sustainable Design Requirements)
   1. Product Material Cost: Provide the cost for material, or an assembled product, including taxes and delivery but excluding any cost for labor and equipment required for installation after the material is delivered to the site.
   2. Product Data for Credit MRc4, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating cost for each product having recycled content.
   3. Product Data for Credit MRc5, Regional Material: For products having regional materials, documentation indicating location of raw material extraction, harvest or recovery, as well as, manufacture (location of final assembly) within 500 miles of project

site. Include statement indicating cost for each material or component of the assembled product.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver wall and door protection items in original, undamaged protective packaging. Label items to designate installation locations.

B. Protect work from moisture damage.

C. Protect work from UV light damage.

D. Do not deliver products to project site until areas for storage and installation are fully enclosed, and interior temperature and humidity are in conformance with manufacturer's recommendations for each type of item.

E. Store products in either horizontal or vertical position, in conformance with manufacturer's instructions.

1.07 QUALITY ASSURANCE

A. Sustainability and LEED Standards Certification:
   1. Regional manufactured products with percentage by weight.
   2. Recycled content calculated as 1/2 preconsumer + postconsumer.

1.08 WARRANTY

A. See Section 01 77 00 - Closeout Procedures, for additional warranty requirements.

B. Correct defective Work within a one year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Corner Guards:
   1. Babcock-Davis: www.babcockdavis.com/#SLE.
   2. Construction Specialties, Inc: www.c-sgroup.com.
   3. Inpro: www.inprocorp.com.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Protective Wall Covering:
   1. Construction Specialties, Inc: www.c-sgroup.com.
   2. Inpro: www.inprocorp.com.
   3. Substitutions: See Section 01 60 00 - Product Requirements.

C. Fiberglass Reinforced Wall Panels:
   1. Marlite; Standard FRP: www.marlite.com
   2. Crane Composites; Sequentia Flat: www.cranecomposites.com
   3. Glasteel; Glasliner FRP: www.glasteel.com
   4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 PRODUCT TYPES

A. Corner Guards - Surface Mounted:
   1. Material: High impact vinyl with full height extruded aluminum retainer.
   2. Width of Wings: 2 inches.
   3. Corner: Square.
   4. Color: As selected from manufacturer's standard colors.
   5. Length: One piece.

B. Protective Wall Covering Type WPM-1, WPM-2, WPM-3:
   1. Material: High-impact acrylic-modified vinyl.
   2. Thickness: 0.040 inch.
   3. Color: As indicated on drawings.
   4. Accessories: Provide manufacturer's standard color-matched trim and moldings.

C. Fiberglass Reinforced Panel Type FRP-1:
   1. Material: Fiberglass reinforced thermosetting polyester resin panel sheets complying with ASTM D 5319
   2. Dimensions:
      a. Thickness: 0.090 inches nominal
      b. Width: 4 foot 0 inches nominal
      c. Length: 9 foot 0 inches (minimum)
   3. Finish: Pebbled / Embossed
   4. Color: White
   5. Accessories: Provide manufacturer's standard color-matched trim and moldings.

D. Interior Wood Veneer Wall Panel System Type WP-1:
   1. Material: Manufactured of 1/32 inch thick wood veneer factory bonded to the face side of a particle board core and factory finished. Panels to have a #4 veneer back.
   2. Thickness: 1/2 inch - 5/8 inch
   3. Edge: Square Edge
   4. Wall Panel Mounting: Demountable Z-clips
   5. Trim: Fry Reglet Trim as indicated on drawings
   6. Finish: As indicated on drawings
   7. Manufacturers:
      a. Basis of Design: Construction Specialties, Inc; Acrovyn: www.c-sgroup.com.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

E. Interior Wood Veneer Wall Panel System Type WP-2:
   1. Material: Manufactured of 1/32 inch thick wood veneer factory bonded to the face side of a particle board core and factory finished. Panels to have a #4 veneer back.
   2. Thickness: 3/8 inch
   3. Edge: Square Edge
   4. Wall Panel Mounting: Adhesive
   5. Trim: Fry Reglet Trim as indicated on drawings
   6. Finish: As indicated on drawings
   7. Manufacturers:
      a. Basis of Design: Construction Specialties, Inc; Acrovyn: www.c-sgroup.com.
      b. Substitutions: See Section 01 60 00 - Product Requirements.

F. Tackable Fabric Wall Panel System:
   1. Material: PCF mineral board wrapped in fabric from guildford of maine or factory-approved, customer-selected material.
   2. Thickness: 1/2 inch
   3. Edge: Square
   4. Wall Panel Mounting: Demoutable Z-clips
   5. Trim: Fry Reglet Trim as indicated on drawings

6. Fabric: As indicated on drawings
7. Manufacturers:
    a. Basis of Design : Kinetics Noise Control Inc.; Hi-Tack Tackable Wall Panels: www.kineticsnoise.com
    b. Substitutions: See Section 01 60 00 - Product Requirements.

2.03 FABRICATION

A. Fabricate components with tight joints, corners and seams.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.

B. Verify that substrate surfaces for adhered items are clean and smooth.

C. Start of installation constitutes acceptance of project conditions.

3.02 INSTALLATION

A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to supporting construction.

B. Position corner guard 4 inches above finished floor to 76 inches high.

3.03 CLEANING

A. Clean wall and door protection items of excess adhesive, dust, dirt, and other contaminants.

END OF SECTION

SECTION 10 28 00
TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Commercial toilet accessories.

B. Commercial shower and bath accessories.

C. Utility room accessories.

D. Special Note: Owner will furnish and install limited items, as noted herein.

1.02 RELATED REQUIREMENTS

A. Section 01 74 19 – Construction Waste Management.

B. Section 01 81 13 – Sustainable Design Requirements.

C. Section 01 81 19 – Indoor Air Quality Requirements.

D. Section 06 10 00 - Rough Carpentry: Concealed supports for accessories, including in wall framing and plates.

E. Section 10 21 13 - Plastic Toilet Compartments.

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.

B. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2015a.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

D. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

E. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium; 2011.

F. ASTM C1036 - Standard Specification for Flat Glass; 2016.

G. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2008 (Reapproved 2013).

1.04 LEED REQUIREMENTS

A. LEED Focus Materials (LFMs) For This Section:
   1. Targeted products containing Recycled Content (MRc4)
   2. Targeted products containing Regional Material (MRc5)

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

1.06 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

C. Manufacturer's Installation Instructions: Indicate special procedures, conditions requiring special attention, and other relevant data.

D. LEED Product and Material Data Summary Form: For all installed products and materials of this Section, complete the "LEED Product and Material Data Summary Form" (attached to end of Section 01 81 13 - Sustainable Design Requirements)
   1. Product Material Cost: Provide the cost for material, or an assembled product, including taxes and delivery but excluding any cost for labor and equipment required for installation after the material is delivered to the site.
   2. Product Data for Credit MRc4, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating cost for each product having recycled content.
   3. Product Data for Credit MRc5, Regional Material: For products having regional materials, documentation indicating location of raw material extraction, harvest or recovery, as well as, manufacture (location of final assembly) within 500 miles of project site. Include statement indicating cost for each material or component of the assembled product.

1.07 QUALITY ASSURANCE

A. Sustainability and LEED Standards Certification:
   1. Regional manufactured products with percentage by weight.
   2. Recycled content calculated as 1/2 preconsumer + postconsumer.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Commercial Toilet, Shower, and Bath Accessories:
   1. Bobrick
   2. AJW Architectural Products: www.ajw.com.
   3. American Specialties, Inc: www.americanspecialties.com.
   4. Bradley Corporation: www.bradleycorp.com.
   5. Georgia-Pacific Professional: www.blue-connect.com.
   6. Kimberly-Clark
   7. Substitutions: Section 01 60 00 - Product Requirements.

2.02 MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
   1. Grind welded joints smooth.
   2. Fabricate units made of metal sheet of seamless sheets, with flat surfaces.

B. Keys: Provide (2) two keys for each accessory to Owner; master key lockable accessories.

C. Stainless Steel Sheet: ASTM A666, Type 304.

D. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.

E. Galvanized Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.

F. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.

G. Adhesive: Two component epoxy type, waterproof.

H. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof.

I. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.03 FINISHES

A. Stainless Steel: Satin finish, unless otherwise noted.

B. Chrome/Nickel Plating: ASTM B456, SC 2, polished finish, unless otherwise noted.

C. Baked Enamel: Pretreat to clean condition, apply one coat primer and minimum two coats epoxy baked enamel.

D. Galvanizing for Items Other than Sheet: Comply with ASTM A123/A123M; galvanize ferrous metal and fastening devices.

E. Shop Primed Ferrous Metals: Pretreat and clean, spray apply one coat primer and bake.

F. Back paint components where contact is made with building finishes to prevent electrolysis.

2.04 TOILET ROOM ACCESSORIES SCHEDULE

	DESCRIPTION	MFR	MODEL #	NOTES
A	**MIRROR** SIZE: 24"W X 48"H (UON)	BOBRICK	B-165	
B	**PAPER TOWEL DISPENSER** D2 HARD ROLL SIZE: 17.5" X 16" X 10"	GEORGIA-PACIFIC	GPC 543-38	FURNISHED BY OWNER
C	**TOILET TISSUE DISPENSER** D2 SINGLE ROLL SIZE: 10.5" X 11.25" X 5.25"	GEORGIA-PACIFIC	GPC 590-09	FURNISHED BY OWNER
C1	**TOILET TISSUE DISPENSER**	BOBRICK	B-2740	
D	**WASTE RECEPTACLE** FREE STANDING			FURNISHED BY OWNER
E	**GRAB BAR** (SEE DWGS FOR SIZES)	BOBRICK	B-6806.99	
G	**SOAP DISPENSER** SURFACE MOUNT			FURNISHED BY OWNER
H	**MOP / BROOM HOLDER** SURFACE MOUNT SIZE: 36" LONG	BOBRICK	B-223	
I	**SANITARY NAPKIN DISPOSAL** SURFACE MOUNT	BOBRICK	B-5270	
J	**SHOWER CURTAIN ROD**	BOBRICK	B-6047	
K	**SHOWER CURTAIN & HOOKS**	BOBRICK	204-2 204-1	

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify exact location of accessories for installation.

C. Verify that field measurements are as indicated on drawings.

D. See Section 06 10 00 for installation of blocking, reinforcing plates, and concealed anchors in walls and ceilings.

3.02 PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation.

B. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions in locations indicated on the drawings.

B. Install plumb and level, securely and rigidly anchored to substrate.

C. Mounting Heights: As required by accessibility regulations, and as indicated on drawings.

3.04 PROTECTION

A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION

SECTION 10 44 00
FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire extinguishers.

B. Fire extinguisher cabinets.

C. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 01 74 19 – Construction Waste Management.

B. Section 01 81 13 – Sustainable Design Requirements.

C. Section 01 81 14 – Volatile Organic Compound (VOC) Limits For Adhesives, Sealants, Paints & Coatings.

D. Section 01 81 19 – Indoor Air Quality Requirements.

1.03 REFERENCE STANDARDS

A. NFPA 10 - Standard for Portable Fire Extinguishers; 2013.

1.04 LEED REQUIREMENTS

A. LEED Focus Materials (LFMs) For This Section
   1. Targeted products containing Recycled Content (MRc4)
   2. Targeted products containing Regional Material (MRc5)
   3. Targeted products to meet VOC requirements (EQc4.1 & EQc4.2)

1.05 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Product Data: Provide extinguisher operational features.

C. Shop Drawings: Indicate cabinet physical dimensions, rough-in measurements for recessed cabinets, mounting measurements for wall bracket, and other relevant information.

D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

G. LEED Product and Material Data Summary Form: For all installed products and materials of this Section, complete the “LEED Product and Material Data Summary Form” (attached to end of Section 01 81 13 - Sustainable Design Requirements)
   1. Product Material Cost: Provide the cost for material, or an assembled product, including taxes and delivery but excluding any cost for labor and equipment required for installation after the material is delivered to the site.
   2. Product Data for Credit MRc4, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating cost for each product having recycled content.

3. Product Data for Credit MRc5, Regional Material: For products having regional materials, documentation indicating location of raw material extraction, harvest or recovery, as well as, manufacture (location of final assembly) within 500 miles of project site. Include statement indicating cost for each material or component of the assembled product.
4. Product Data for Credit EQc4.1, Adhesives & Sealants: For adhesives and sealants, documentation including printed statement of VOC content and chemical components.
5. Product Data for Credit EQc4.2, Paints & Coatings: For paints and coatings, documentation including printed statement of VOC content and chemical components.

1.06 QUALITY ASSURANCE

A. Sustainability and LEED Standards Certification:
   1. Regional manufactured products with percentage by weight.
   2. Recycled content calculated as 1/2 preconsumer + postconsumer.
   3. VOC content limitations defined in Section 018114, "Volatile Organic Compound (VOC) Limits For Adhesives, Sealants, Paints, and Coatings."

1.07 FIELD CONDITIONS

A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Extinguishers:
   1. Amerex Corporation : www.amerex-fire.com
   2. Potter-Roemer : www.potterroemer.com.
   3. JL Industries, Inc: www.jlindustries.com.
   4. Elkhart
   5. Substitutions: See Section 01 60 00 - Product Requirements.

B. Fire Extinguisher Cabinets and Accessories:
   1. Larsen's Manufacturing Co: www.larsensmfg.com.
   2. Nystrom, Inc: www.nystrom.com/sle.
   3. Potter-Roemer: www.potterroemer.com.
   4. JL Industries, Inc: www.jlindustries.com.
   5. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.

B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gage.
   1. Class: A:B:C type.
   2. Size: 10 pound.
   3. Finish: Baked polyester powder coat, color as selected.
   4. Temperature range: Minus 40 degrees F to 120 degrees F.
   5. Provide in recessed cabinet every 75 feet in corridors.

C. Wet Chemical Type Fire Extinguishers: Stainless steel tank, with pressure gage.
   1. Class: K type.
   2. Size and classification as scheduled.

3. Finish: Polished stainless steel.
4. Temperature range: Minus 20 degrees F to 120 degrees F.
5. Provide at Kitchen (Maximum travel distance from cooking fire hazard to extinguisher = 30 feet). Provide minimum of 3.

2.03 FIRE EXTINGUISHER CABINETS

A. Cabinet Configuration: Semi-recessed type.
   1. Exterior nominal dimensions of 12 inch wide by 27 inch high by 8 inch deep.

B. Door: 0.036 inch metal thickness, reinforced for flatness and rigidity with nylon catch. Hinge doors for 180 degree opening with two butt hinge.

C. Finish of Cabinet Exterior Trim and Door: Baked enamel, White color.

D. Finish of Cabinet Interior: White colored enamel.

2.04 ACCESSORIES

A. Extinguisher Brackets: Formed steel, galvanized and enamel finished.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

END OF SECTION

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SECTION 10 51 00
LOCKERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Refer to Scope Information Sheets for this contract bound in the Project Manual under Section 01 1000, Summary of Work. The Scope Information Sheets describe generally the work included in each contract, but the work is not necessarily limited to that described.

B. Metal lockers.

C. Locker units with hinged doors.

D. Metal filler panels.

1.02 RELATED REQUIREMENTS

A. Section 01 74 19 – Construction Waste Management.

B. Section 01 81 13 – Sustainable Design Requirements.

C. Section 01 81 19 – Indoor Air Quality Requirements.

D. Section 06 10 00 - Rough Carpentry: Wood base construction.

E. Section 06 20 00 - Finish Carpentry: Finish top and end panels.

1.03 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

1.04 LEED REQUIREMENTS

A. LEED Focus Materials (LFMs) For This Section
   1. Targeted products containing Recycled Content (MRc4)
   2. Targeted products containing Regional Material (MRc5)

1.05 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Product Data: Manufacturer's published data on locker construction, sizes and accessories.

C. Shop Drawings: Indicate locker plan layout, numbering plan.

D. LEED Product and Material Data Summary Form: For all installed products and materials of this Section, complete the “LEED Product and Material Data Summary Form” (attached to end of Section 01 81 13 - Sustainable Design Requirements)
   1. Product Material Cost: Provide the cost for material, or an assembled product, including taxes and delivery but excluding any cost for labor and equipment required for installation after the material is delivered to the site.
   2. Product Data for Credit MRc4, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating cost for each product having recycled content.
   3. Product Data for Credit MRc5, Regional Material: For products having regional materials, documentation indicating location of raw material extraction, harvest or recovery, as well as, manufacture (location of final assembly) within 500 miles of project

site. Include statement indicating cost for each material or component of the assembled product.

1.06 QUALITY ASSURANCE

A. Sustainability and LEED Standards Certification:
   1. Regional manufactured products with percentage by weight.
   2. Recycled content calculated as 1/2 preconsumer + postconsumer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect locker finish and adjacent surfaces from damage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Metal Lockers:
   1. Basis of Design:
      a. Penco Products, Inc.: www.pencoproducts.com
   2. Other Acceptable Manufacturers:
      a. Art Metal Products: www.artmetalproducts.com.
      b. WEC Manufacturing, Inc.
      c. List Industries, Inc.; www.listindustries.com
      d. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 METAL LOCKERS

A. Lockers: Factory assembled, made of formed sheet steel, ASTM A653/A653M SS Grade 33/230, with G60/Z180 coating, stretcher leveled; metal edges finished smooth without burrs; baked enamel finished inside and out.
   1. Color: To be selected by Architect.

B. Locker Body: Formed and flanged; with steel stiffener ribs; electric spot welded.

C. Frames: Formed channel shape, welded and ground flush, welded to body, resilient gaskets and latching for quiet operation.

D. Doors: Hollow double pan, sandwich construction, 1-3/16 inch thick; welded construction, channel reinforced top and bottom with intermediate stiffener ribs, grind and finish edges smooth.
   1. Form recess for operating handle and locking device.
   2. Provide louvers in door face, top and bottom, for ventilation.

E. Hinges: Two for doors under 42 inches high; three for doors over 42 inches high; weld securely to locker body and door.

2.03 MATERIALS

A. Sheet Steel: ASTM A653/A653M SS Grade 33/230, with G60/Z180 coating, stretcher leveled; to the following minimum thicknesses:
   1. Body and Shelf: 24 gage, 0.024 inch.
   2. Door Outer Face: 16 gage.
   3. Door Frame: 16 gage, 0.060 inch.
   4. Hinges: 14 gage, 0.075 inch.
   5. Base: 20 gage, 0.036 inch.
   6. Sloping Top: 20 gage, 0.036 inch.
   7. Trim: 20 gage, 0.036 inch.

B. Accessories For Each Locker: Two single prong wall hooks, rubber bumper.

2.04 LOCKER UNITS - TYPE 1

A. Width: 15 inches.

B. Depth: 15 inches.

C. Height: 30 inches.

D. Configuration: single tier.

E. Mounting: Free standing and surface mounted.

F. Base: Fabricate for wood base.
   1. Base Height: 4 inch.

G. Top: Flat metal with closures.

H. Locking: Equipped for padlock hasps.
   1. Provide custom hasp locations:
      a. Low locker: locate padlock hasp near top of door.

I. Ventilation Method: Door louvers.

J. Class: Quiet.

K. Locker Body: Formed and flanged; with steel stiffener ribs; electric spot welded.

L. Frames: Formed channel shape, welded and ground flush, welded to body, resilient gaskets and latching for quiet operation.

M. Doors: Hollow channel edge construction, 1-3/16 inch thick; welded construction, channel reinforced top and bottom with intermediate stiffener ribs, grind and finish edges smooth.

N. Hinges: Two for doors under 42 inches high; three for doors over 42 inches high; weld securely to locker body and door.

O. Number Plates: Provide rectangular shaped aluminum plates. Form numbers 3/4 inch high of block font style with ADA designation, in contrasting color.

P. Provide ventilation openings at top and bottom of each locker.

Q. Form recess for operating handle and locking device.

R. Finish edges smooth without burrs.

S. Fabricate metal tops, ends and closure pieces.

T. Refer to Section 06 20 00 - Finish Carpentry for finished top and ends.

U. Provide end panels and filler strips.

2.05 LOCKER UNITS - TYPE 2

A. Width: 15 inches.

B. Depth: 15 inches.

C. Height: 60 inches.

D. Configuration: double tier.

E. Mounting: Surface mounted.

F. Base: Fabricate for wood base.

1. Base Height: 4 inch.

G. Top: Flat metal with closures.

H. Locking: Equipped for padlock hasps.
   1. Provide custom hasp locations:
      a. Top locker: locate padlock hasp near bottom of door.
      b. Bottom locker: locate padlock hasp near top of door.

I. Ventilation Method: Door louvers.

J. Class: Quiet.

K. Locker Body: Formed and flanged; with steel stiffener ribs; electric spot welded.

L. Frames: Formed channel shape, welded and ground flush, welded to body, resilient gaskets and latching for quiet operation.

M. Doors: Hollow channel edge construction, 1-3/16 inch thick; welded construction, channel reinforced top and bottom with intermediate stiffener ribs, grind and finish edges smooth.

N. Hinges: Two for doors under 42 inches high; three for doors over 42 inches high; weld securely to locker body and door.

O. Number Plates: Provide rectangular shaped aluminum plates. Form numbers 3/4 inch high of block font style with ADA designation, in contrasting color.

P. Provide ventilation openings at top and bottom of each locker.

Q. Form recess for operating handle and locking device.

R. Finish edges smooth without burrs.

S. Fabricate metal tops, ends and closure pieces.

T. Provide end panels and filler strips.

2.06 FINISHING

A. Clean, degrease, and neutralize metal; prime and finish with one coat of baked enamel.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that prepared bases are in correct position and configuration.

B. Verify bases are properly sized.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install lockers plumb and square.

C. Place and secure on prepared base.

D. Secure lockers with anchor devices to suit substrate materials. Minimum Pullout Force: 100 lb.

E. Bolt adjoining locker units together to provide rigid installation.

F. Install end panels and filler panels.

G. Install accessories.

H. Replace components that do not operate smoothly.

3.03 CLEANING

A. Clean locker interiors and exterior surfaces.

END OF SECTION

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SECTION 10 82 10
ALUMINUM EQUIPMENT SCREEN

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fixed, extruded-aluminum louvered roof top equipment screen

1.02 RELATED REQUIREMENTS

A. Section 05 12 00 - Structural Steel Framing: Mounting substrates.

1.03 REFERENCE STANDARDS

A. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2013.

B. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2013.

C. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2014.

D. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs; 2017.

1.04 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Shop Drawings: Submit detailed shop drawings, indicating component profiles, sections, finishes, fastening details, special details, and manufacturer's technical and descriptive data.
   1. Include field dimensions of openings and elevations on shop drawings.
   2. Indicate distinction between factory-assembled and field-assembled work on shop drawings.

C. Samples: Submit samples for color verification, 10 inches by 10 inches minimum.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with minimum three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site in manufacturer's original, unopened packaging, with labels clearly identifying manufacturer and material.

B. Store materials indoors, protected from moisture, humidity, and extreme temperature fluctuations.

1.07 WARRANTY

A. See Section 01 77 00 - Closeout Procedures, for additional warranty requirements.

B. Correct defective work within a one year period after Date of Substantial Completion.

C. Finish Warranty: Provide manufacturer's twenty (20) year warranty on factory finish against cracking, peeling, and blistering.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design: Industrial Louvers, Inc.: www.industriallouvers.com.

B. Other Acceptable Manufacturers - Aluminum Grilles:
   1. Architectural Louvers Co.: www.archlouvers.com.
   2. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 EXTRUDED ALUMINUM HORIZONTAL BLADE EQUIPMENT SCREENS

A. Fabrication:
   1. Model: 650XPI
   2. Blades:
      a. Style: Horizontal
      b. Material: Extruded aluminum, 6063-T6
      c. Wall Thickness: 0.081 inch (2.1 mm), nominal
      d. Angle: 40 degrees
      e. Centers: 6.875 inches (174.6 mm), nominal
   3. Supports: as required per wind load

2.03 FABRICATION

A. Shop fabricate grilles to the greatest extent possible.

B. Disassemble as neccessary for shipping and handling, clearly mark units for proper reassembly.

C. Provide supports, anchorages, and accessories as required for complete assembled system.

2.04 FINISHES

A. Superior Performing Organic Coatings: AAMA 2605 multiple coats, thermally cured polyvinylidene fluoride system.

B. Finish Color: As selected by Architect from manufacturer's standard color range.

2.05 ACCESSORIES

A. Fasteners: ASTM F593 stainless steel or ASTM A307 carbon steel, sizes to suit installation conditions.

B. Anchors and Inserts: Corrosion resistant; type, size, and material required for loading and installation as indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.

B. Verify that painting, roofing, masonry work, and other adjacent work that might damage grille finish has been completed prior to start of installation.

3.02 INSTALLATION

A. Install in accordance with manufacturer's written installation instructions.

B. Set equipment screens level, plumb, with uniform joints, and in alignment with adjacent work as indicated.

C. Mechanically secure screens to supporting structure.

D. Do not cut or trim aluminum members without approval of manufacturer; do not install damaged members.

3.03 CLEANING

A. Clean finished surfaces as recommended by manufacturer and maintain clean condition until Date of Substantial Completion.

B. Touch-up damaged finish coating using material provided by manufacturer to match original coating.

C. Replace grilles that have been damaged beyond touch-up repair.

3.04 PROTECTION

A. Provide protection of installed grilles to ensure grilles are without damage until Date of Substantial Completion.

END OF SECTION

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SECTION 11 4 000

FOODSERVICE EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract including General and Supplementary Conditions and Division 1 Specification Sections apply to this Section.

1.2 SUMMARY

A. Provide all material, labor, equipment and services required to execute and complete all items of work relating to the food service equipment, both existing and new, all as required to make the resulting facility a fully functional and reliable operating unit in accordance with this Specification. All food service equipment shall be furnished as specified, delivered prepaid, unloaded and uncrated, assembled with all components and accessories connected within the equipment, set-in-place in proper location as indicated on the drawings, leveled and fastened to the wall, ceiling or floor as required, left ready for final utility connections. The work shall include:

1. To prevent extended warehousing of all food service equipment, no pre-ordering of equipment is permitted; schedule ordering of the equipment so that warehousing of the equipment shall not be required for longer than 60 days prior to delivery to the site for installation.
2. All food service equipment shall have a manufacturer extended warranty covering parts and labor for a period of two years which shall take effect only after acceptance and beneficial use by the District. All labor shall be performed by a factory authorized and qualified representative.
3. A “complete and thorough” demonstration and start-up for each item of equipment must be conducted by a qualified manufacturer representative in the use, sanitation and maintenance of the equipment.

B. Furnishing scheduled items of custom fabricated food service equipment as specified utilizing a food service equipment fabricator listed with the National Sanitation Foundation (NSF) for custom equipment fabrication.

C. Delivery of food service equipment in factory fabricated containers designed to protect equipment and finish until final installation. Delivery of food service equipment shall be coordinated with the construction schedule. If necessary, delivery of the food service equipment shall be by means other than common carrier to expedite delivery and to maintain project schedule.

D. Warehousing of the food service equipment in a bonded warehouse and re-delivery of the food service equipment from the storage facility to the project site or arrangement for secured storage at the project site to assure availability of the food service equipment to maintain project schedule.

E. Field installation of the food service equipment including buy out equipment at the project site including on site receiving and unloading, uncrating from packing containers, conveyance of the food service equipment from the receiving area to the installation location, erection and assembly of the food service equipment including field welding and polishing of sub assemblies and installation of fixtures and components and setting in place in final location.

F. Removal and disposal of all packing material.

G. All costs for special tools, crane rental or usage cost or rigging as may be required for delivery or installation of the food service equipment.

H. All work is to be performed by skilled labor utilizing the proper Trades having respective jurisdiction thereto. All work shall be performed at hours required to maintain consistent work schedules with all other Trades without additional cost.

I. Preparation of dimensioned utility rough-in floor plans coordinated with the Contract Documents and site conditions and the food service equipment manufacturers' utility connection points for all food service equipment.

J. Assist in the preparation of "chalk-line" mark-up of utility rough-in locations on the building floor at the job site.

K. Take complete financial responsibility for any and all additional expenses resulting from incomplete or inaccurate rough-in drawings or instructions for the final rough-in dimensioning at the job site.

L. Provide complete manufacturers' and fabricator shop drawings of all related items of food service equipment.

M. Provide competent on-site supervision for the coordination of work and to assist and supervise the erection, assembly and installation of the food service equipment, this shall include any moving, shifting or disassembly of the food service equipment to enable work to be performed free of obstruction.

N. Attend all job conferences and meetings.

O. Maintaining coordination and control over the form, fit, function and utility requirements of all food service equipment, from placement of purchase orders through Final Acceptance.

P. Provide competent on-site final testing, demonstration and instruction in the use and service of all items of food service equipment in the form of a qualified manufacturer's representative for each item of food service equipment.

Q. Providing access to the custom equipment fabricator's shop for inspection of construction and materials used at any time during the progress of fabrication.

R. Field verification of all measurements at the project site prior to the fabrication of custom fabricated and buy-out equipment and correct any deviation from the dimensions indicated on any plans and shop drawing which may affect the final form or fit of any item of food service equipment as a result of final building conditions and actual field dimensions.

S. All food service equipment shall conform to field verified dimensions and to the finished building conditions with edges scribed and sealed to wall surfaces, fitting to and around building obstructions. All joints, seams or surfaces shall be fully sealed with General Electric or equivalent clear silicone sealer.

T. Field verification of delivery access into and through the building to the final equipment location including access and clearance through hallways, doorways and elevators (cab size and weight restrictions); furnish food service equipment in sections or sub-assemblies as required for access.

U. Keeping the premise free from accumulation of waste material and rubbish caused by his work. At the completion of each workday all waste material and rubbish must be removed and all areas swept broom clean.

V. Physical damage to equipment, building or previous work completed or in the process of completion shall be repaired or replaced.

W. Furnish as part of and affixed to the food service equipment, accessories, components and fixtures furnished standard with the equipment as specified or listed as an option and shall include the following:

1. PLUMBING ACCESSORIES: Pop-up, lever or basket type waste outlets, tailpieces, standing or connected overflows, faucets and spray units, vacuum breakers, shut-off and control valves and fittings.
2. STEAM AND GAS ACCESSORIES: Steam supply valves, thermostats, pressure reducing and regulating valves, shut-off and control valves, temperature and pressure gauges, copper steam coils or injector assemblies, traps and fittings
3. ELECTRICAL ACCESSORIES: Terminal blocks, conduit, wiring, signal and pilot lamps, on-off and control switches, control panels, magnetic contactor assemblies, heating elements, junction boxes, outlet boxes and receptacles and cord and plug sets.
4. REFRIGERATION ACCESSORIES: Copper insulated refrigeration tubing, valves, fittings, hangers, high- and low-pressure control switches, solenoid valves, evaporator coils, expansion valves, condensing units and condensate evaporators.

X. All built-in accessories, components and fixtures shall be factory installed at the time of fabrication and shall comply with all applicable codes and regulations.

Y. Furnish and install copper insulated refrigeration lines from compressor location to evaporator coils and expansion valves for all refrigeration units and ice makers with remote or refrigeration systems other than self-contained.

Z. Furnish and install flexible stainless-steel gas flue tubing from exhaust collar on gas hot water booster heater terminating at the exhaust vent connection at the vent extension or condensate hood.

AA. Furnish 14-gauge galvanized steel welded roof curbs for all refrigeration condensing unit stands and exhaust fans and supply fan make-up air units including setting-in-place and securing to the building roof.

BB. Furnish and install in exhaust hood, plenum, duct and surface fire protection system. Entire system shall be furnished and installed in compliance with UL Standard 1254, UL Standard 300, NFPA 96 and any prevailing statutes or codes including automatic shut-down of all cooking appliances per code section 44 of NFPA 17A-27. The manufacturer of the fire suppression system shall be ISO 9001 registered. The entire installation must conform to ADA (American Disabilities Act) latest edition. The system shall be an automatic fire suppression system using a wet chemical agent for grease related fires. The system shall be the pre-engineered type having minimum and maximum guidelines established by the manufacturer and listed by Underwriters Laboratories (UL). The system shall be installed and serviced by certified personnel trained by the manufacturer. Provide as part of fire system, mechanically operated gas supply line shut-off valve to interrupt gas supply to all gas operated cooking appliances. Gas valve shall be provided with manual reset to prevent gas flow to pilot devices on appliances prior to restart.

CC. Furnish and install remote and self-contained refrigeration system complete with condensing unit and insulated copper refrigeration lines charged with R448A refrigerant. Condensing unit shall be interconnected to a low profile, high velocity evaporator coil. Refrigeration system shall include all fittings, valves, switches, controls and all related components to comprise a complete operating unit of sufficient BTU capacity to maintain automatic operation of 35-degree F product temperature in coolers and -10-degree F product temperature in freezers. Refrigeration system provided with outdoor remote air-cooled condensing unit shall be provided with winterized controls (low ambient package) including crankcase heater, line dryers and head pressure control unless specified as part of a pre-assembled refrigeration rack system. Refrigeration lines to be run within any slab or floor shall be either hard copper or soft copper if run within conduit.

DD. All electrical wiring, plumbing lines, gas lines (except exposed threaded pipe gas manifolds at cooking appliances), steam lines and refrigeration lines shall be concealed in the floor, walls or above the finished ceiling in an acceptable manner and in compliance with all applicable codes. Where it is impractical to run lines within the floor, walls or above the finished ceiling, lines shall be enclosed in a stainless steel

(or alternate "smooth and cleanable" approved material) with appropriate access for service or replacement. In situations of an island arrangement or where equipment is not situated with access to a wall surface, lines must be installed in the floor in an approved manner including in-ground conduit for refrigeration and beverage lines. In no case shall any lines be "exposed".

EE. Furnish materials and install all interconnecting wiring as required for the food service equipment, this shall include inter-wiring of control panels furnished as a part of a fixture or appliance, on-off switches for light fixtures furnished as a part of a fixture or appliance, inter-wiring of control devices to motors furnished as a part of a fixture or appliance, time clock circuits for freezers from remote condensing unit to evaporator coil, heated pressure relief ports in walk-in freezer, electrical receptacles furnished as a part of a fixture or appliance, light fixtures in walk-in refrigeration to on-off switches and conduit junction boxes, ceiling mounted heat lamps to remote wall switch and inter-wiring of food waste disposer from control device to disposer motor as required to complete the installation of the food service equipment. This work does not pertain to the any of the exhaust and supply ventilation systems on the project.

FF. Furnish materials and install heat tracing tape to all condensate lines within walk-in freezer; insulate entire heat tracing tape with foam pipe insulation.

GG. Furnish materials and install all interconnecting plumbing as required for the food service equipment, this shall include faucets, drains, drains with connected overflow, shut-off valves, vacuum breakers, flow or pressure control valves, gauges, bleeder tubes, piping from disposer control devise to disposer cone and disposer body inlets and piping for steam operated equipment from boiler take-off valve at steam generator to steam inlet connection at appliance as required to complete the installation of the food service equipment.

HH. Furnish materials and install insulated copper interconnecting piping between the dishmachine and the hot water booster heater, this shall include the installation of pressure and temperature gauges, strainer and shock absorber in the hot water supply line to the booster heater.

II. Furnish and install copper condensate lines in walk-in refrigeration from evaporator coil to waste receptor.

JJ. Furnish and install gas supply shut-off valve at each gas manifold connection and furnish and install flexible gas hose connectors to each shut-off valve and to each cooking appliance.

KK. Furnish materials and install interconnecting chrome plated exposed piping for hose reel and hose bibs including installation of check valves and vacuum breaker in supply line; this shall include chrome plated bleeder outlet if required by local health department regulations or local plumbing codes.

1.3 WORK BY THE ELECTRICAL TRADE

A. Rough-in utility connections including proper voltage, phase and amperage required to satisfactorily operate all items of food service equipment.

B. Final connection of the food service equipment from the rough-in location to the connection point on all food service equipment and necessary connection points.

C. All electrical components for the exhaust and supply ventilation system (including condensate hoods and pant leg vent systems) including, electrical disconnects, starters, exhaust fan on-off switch with indicator lights located in kitchen and supply fan controller with indicator lights located in kitchen and dishroom.

D. Furnishing and installation of all accessories, components and fixtures other than those specified as part of the food service equipment, to include but not be limited to, electrical circuit breakers or fuses, electrical receptacles, disconnect switches, on-off switches or other fittings and appurtenances that are

required to connect the food service equipment in accordance with manufacturer's instructions and result in proper operation.

E. Utility disconnection and termination of discontinued services of existing food service equipment to be terminated.

F. Furnishing and installing electrical plug and cord sets where not furnished as part of the appliance.

G. Electrical contractors or shunt-trip circuit breakers to interrupt electrical power to all electrically operated food service cooking appliances.

H. In-floor, flush mounted, waterproof electrical receptacles of type and capacity to match plug and cord sets for all mobile food service counter equipment.

I. Ceiling mounted, retractable drop cords to accommodate food service equipment in an island arrangement, of the type and capacity to match plug and cord sets of the food service appliances.

J. Furnishing materials and installation of all interconnecting wiring as required for the food service exhaust ventilation and fire suppression systems; this shall include wiring of electrically operated gas supply shut-off valves for fire suppression systems, fire suppression system wiring to building fire alarm, heat detector electrical detection device to automatically start supply and exhaust fans and exhaust hood light fixtures to remote wall switch.

1.4 WORK BY THE PLUMBING TRADE

A. Rough-in utility connections including gas, steam, hot and cold water and floor receptors and drains in proper sizes, pressures and quantities required to satisfactorily operate all items of food service equipment.

B. Final connection of the food service equipment from the rough-in location to the connection point on all food service equipment and necessary outlets.

C. Furnishing and installation of all accessories, components and fixtures other than those specified as part of the food service equipment, to include but not be limited to stop cocks, traps, pipe, shut-off valves, pressure reducing valves or other fittings and appurtenances that are required to connect the food service equipment in accordance with manufacturer's instructions and result in proper operation.

D. Furnish materials and install insulated copper interconnecting piping between the dishmachine and the hot water booster heater, this shall include the installation of pressure and temperature gauges, strainer and shock absorber in the hot water supply line to the booster heater.

E. Furnishing and installing chrome plated indirect waste outlet piping for food service equipment, from the waste outlet connection on the food service equipment to the building waste receptacle (floor sink, etc.).

F. Flushing and sanitizing of lines before making final connections to the food service equipment.

G. Grease interceptors for food service equipment in capacity and size as required by code.

H. Furnish and install exposed threaded gas manifold piping for all cooking appliances and welded in-wall gas manifold piping.

I. Install gas shut-off valve supplied as part of the fire suppression system in the gas supply line in an exposed and accessible location.

J. Furnish materials and install water filter assemblies, sized and of the proper type to accommodate the water flow rate and “particulate” requirement of the food service equipment; this shall include all combi and bake ovens, steam cookers, proofing cabinets, ice makers, coffee brewing equipment and soda and beverage dispensing equipment.

1.5 WORK BY THE MECHANICAL TRADE

A. Supply and exhaust ventilation for indoor refrigeration condensing units based on 750 cfm for each air-cooled compressor horsepower and 250 cfm for each water-cooled compressor horsepower.

B. Exhaust ventilation for condensate applications including fully welded 18-gauge stainless steel or 12-gauge aluminum liquid tight ductwork pitched toward source to prevent leaking, fan and start-sop switch with indicator lights located in the dishroom.

C. Exhaust hood exhaust ventilation system including roof top mounted “utility set” type up-blast centrifugal fan with backward incline wheel, adjustable sheaves, vibration mounts and bird screen at discharge end; fan shall be rated at 14 sones or less and shall be UL 710 listed; roof curb, exhaust ductwork constructed of a minimum 16 gauge galvanized steel or 18 gauge stainless steel, fully welded liquid tight with clean-outs at every major bend and in 20 foot intervals; ductwork shall not exceed a three to one aspect ratio, connection to exhaust fan shall include a UL listed and rated vibration eliminator and ductwork shall be insulated with all prevailing codes.

D. Exhaust hood supply ventilation system including roof top mounted UL listed supply fan with vibration mounts, adjustable sheaves, roof curb, bird screen at intake end, maintainable filtration system, and gas or electric heated supply air heater (supply air heater heat incoming supply air below a 65-degree F ambient temperature) and 22-gauge galvanized steel ductwork.

E. Disconnection and termination of discontinued ductwork of existing exhaust or condensate hoods to be terminated or relocated, and modification or preparation of exhaust system for existing exhaust or condensate hoods to be relocated at the new location.

1.6 WORK BY THE CONSTRUCTION TRADE

A. Masonry bases, floor curbs, structural pads, floor depressions, roof curbs, flues and fireproof duct shafts or enclosures.

B. Conduit for beverage lines (PVC if embedded in concrete or smooth aluminum if exposed) with 24" radius sweep bends and 24" x 24" pull boxes every 100 lineal feet or three turns including sleeves any through walls, floors and ceilings.

C. Sleeves and openings through wall, floors and ceilings for passage of refrigeration lines.

D. Wall blocking or reinforcing to adequately support wall mounted food service equipment or fixtures; provide 3/4" thick exterior grade plywood backing for wood stud applications and 16-gauge steel backing for metal stud applications.

E. Stainless steel or FPR wall paneling behind all mop receptors, dishtables and pot / utensil washing sinks.

F. Installation of floor pans in floor depression with floor pans set flush and finished watertight around entire perimeter at juncture with floor surface.

G. Conduit for refrigeration lines (PVC if embedded in concrete or smooth aluminum if exposed) with 24" radius sweep bends including sleeves any through walls, floors and ceiling.

1.7 WORK BY THE ROOFING TRADE

A. Roof penetrations properly sealed and flashed to prevent water penetration.

1.8 BIDDING INSTRUCTIONS AND QUALIFICATION OF BIDDER

A. The primary items of food service equipment described in this specification are considered the basis of the bid. Only "equal" items listed as part of this specification will be considered and must meet the conditions of the base bid item; this shall include all materials and material finishes, fabrication methods, electrical, plumbing, and mechanical components, electrical control devices, hardware, accessories and options, exactly as specified without exception. It will be the full and complete responsibility of the Food Service Equipment Contractor to pay any and all costs incurred in adapting any other "equal" item to the mechanical, electrical, exhaust ventilation or structural systems of the building including any other cost increase incurred as a result of engineering changes to the mechanical, electrical, exhaust ventilation, architectural, structural or food service drawings. The contract is to be awarded as follows:

1. The competence and responsibility of the bidder.
2. An itemized cost breakdown of each scheduled item of food service equipment is required, as specified, in order that the District may, at his option, delete any item or supply any portion thereof, or increase the quantity of any item without affecting the cost quoted for the remaining items. "Pre-approved" substituted items must be submitted as an add or deduct alternate in addition to the base bid.
3. The District is not obligated to accept the lowest or any other bid. The award of the contract and choice of the food service equipment Contractor shall be at the District's discretion.

B. Each bidder shall be responsible to visit the project site of the proposed work and fully acquaint himself with conditions as they exist.

C. Each bidder is responsible to attend any pre-bid meeting as required by the District.

D. Each bidder shall be responsible to examine and review the contract document drawings and specifications. Should the bidder find during examination of the drawings and specifications any discrepancies, omissions, ambiguities, or conflicts in or among the contract documents or shall be in doubt as to their meaning, the District shall be notified no later than four working days prior to bid opening for clarification.

E. The failure or omission by any bidder to receive or examine any form, instrument or document or to visit the project site shall in no way relieve him from obligation with respect to his bid. No claims for any extras will be allowed due to unintentional errors, conflicts, or omissions in the contract documents drawings or specifications.

1.9 SUBMITTALS

A. Product Data: For each buy-out item of food service equipment indicated. Include manufacturer's model number and accessories and requirements for access and maintenance clearances, water and drainage, power or fuel and service connections including roughing-in dimensions

B. Shop Drawings: For food service equipment not manufactured as standard production and catalog items by manufacturers. Shop drawings shall include the following information:

1. Dimensioned rough-in plans scaled at 1/4"=1'-0" accurately locating connection points and indicating utility data for all mechanical, electrical and supply and exhaust ventilation requirements.

2. Dimensioned plans scaled at ½"=1'-0" accurately locating and indicating the finished size of masonry bases, floor depressions in structural slabs, stub walls, curbs and finished openings for pass-thru equipment.
3. Dimensioned plans scaled at 1/4"=1'-0" accurately locating conduit and pull boxes for beverage and refrigeration lines including floor, wall and ceiling penetrations and termination points.
4. Dimensioned plans and detailed drawings of all custom fabricated food service equipment scaled at 3/4"-1'-0" for plan and elevation views and 1-½"=1'-0" for sectional views.

C. Copies of original maintenance and repair manuals including a list of all authorized service agencies responsible for each item of food service equipment.

1.10 QUALITY ASSURANCE

A. Manufacturer's qualifications shall include a firm that has regularly engaged in the manufacturing of food service equipment of the same type, capacity, performance and size as specified and whose products have been in similar service for not less than five years.

B. Custom fabricator qualifications for custom food service equipment shall include a skilled sheet metal shop with a minimum of five years' experience in custom sheet metal food service equipment fabrication of similar type as specified. All custom food service equipment shall be fabricated at the same shop.

C. Installer's qualifications shall include a firm with at least three years of successful installation experience on projects with a similar scope to that as required for this project.

D. Food service equipment dealers' qualifications shall include a firm which is regularly engaged in the purchasing of food service equipment as is a manufacturer authorized agent of the specified equipment for not less than five years. The dealer shall also employ a full time project management staff to oversee the purchase of the equipment in compliance with the specifications, coordinate the form and fit of the equipment to the project site conditions, attend all project meetings, coordinate shop drawing review, coordinate installation with the Trades, coordinate factory training and address all issues as they relate to the satisfactory completion of the facility in compliance with the specifications and related documentation.

E. Codes and Standards: All food service equipment furnished and installed under this specification shall be manufactured in strict compliance with the following publications or the current or revised related publication as well as all state, national and local codes and agencies having jurisdiction over same:

1. National Electrical Manufacturer Association NEMA
    a. ICS-77 Industrial Controls and Systems
2. National Electrical Manufacturer Association NEMA
    a. ICS-77 Industrial Controls and Systems
    b. 17.4 Local Application System
    c. 17.13 Water Sprinkler Systems
    d. 96-76 Installation of Equipment for the Removal of Smoke and Grease Laden Vapors for Commercial Cooking Equipment
3. National Sanitation Foundation NSF
    a. 11 76 Food Service Equipment
    b. 4 73 Commercial Cooking and Warming Equipment
    c. C-2-72 Special Equipment and/or Devices
4. National Electrical Manufacturer Association NEMA
    a. 57-78 Electric Lighting Fixtures
    b. 197-78 Commercial Electric Cooking Appliances
    c. 300 Fire Extinguishing Systems

F. All food service equipment shall be manufactured in strict compliance with standards as set forth by the National Sanitation Foundation (NSF) including fabrication of custom-built equipment and shall be listed with same and shall bear their seal. Any item of food service equipment lacking the NSF seal will be rejected.

G. All electrically operated food service equipment shall be constructed in strict compliance with standards as set forth by the Underwriters Laboratories (UL) and shall utilize approved components and assemblies and shall bear the label thereof.

H. Custom fabricated food service equipment shall be constructed to the standards as set forth by the National Association of Food Equipment Manufacturers (NAFEM).

I. All refrigeration equipment and all pressurized vessels shall be constructed, approved, inspected, registered and stamped and installed in strict compliance with the American Society of Mechanical Engineers (ASME), state and local codes for Unfired Pressure Vessels and all other agencies having jurisdiction thereof.

J. All gas operated food service equipment shall be fabricated in strict compliance with standards as set forth by the Underwriter Laboratory (UL) and shall be listed with same and shall bear their seal.

K. Steam operated equipment shall be fabricated and installed in accordance with Pennsylvania Department of Labor and Industry standards.

L. Product Options: Drawings indicate food service equipment based on the specific products indicated. Other manufacturers' equipment with equivalent size and performance characteristics may be considered.

M. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings." Review methods and procedures related to food service equipment including, but not limited to the following:

1. Review access requirements for equipment delivery.
2. Review equipment storage and security requirements.
3. Inspect and discuss condition of substrate and other preparatory work performed by other Trades.
4. Review structural loading limitations.
5. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment and facilities needed to make progress and avoid delays.

1.11 DELIVERY, STORAGE AND HANDLING

A. Deliver food service equipment as factory-assembled units with protective crating and covering.

B. Store food service equipment in original protective crating and covering and in a dry location.

1.12 PROJECT CONDITIONS

A. Field Measurements: Verify dimensions of food service equipment installation areas by field measurements before equipment fabrication and indicate measurements on Shop Drawings and Coordination Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.13 COORDINATION

A. Coordinate equipment layout and installation with other work including light fixtures, HVAC equipment and fire-suppression system components.

B. Coordinate location and requirements of service-utility connections.

C. Coordinate size, location and requirements of concrete bases, positive slopes to drains, floor depressions and insulated floors. Concrete, reinforcement and formwork requirements are specified in Division 3 Section “Cast-in-Place Concrete”.

D. Coordinate installation of roof curbs, equipment supports and roof penetrations, as specified in Division 7 Section “Roof Accessories”.

1.14 WARRANTIES

A. General Warranty: The special warranty specified in this Article shall not deprive the District of other rights the District may have under other provisions of the Contract Documents and shall be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

B. All buy-out food service equipment herein specified shall have all parts and labor warranted in writing, from the date of Final Acceptance by the District against defective parts, materials, workmanship and design for a period of time as stated within the manufacturers standard published warranty, but no less than two years.

C. All custom fabricated food service equipment shall be warranted as stated above except for a period of two years.

D. Refrigeration equipment shall include start-up and two-year parts and labor warranty on the entire refrigeration system and manufacturers five-year parts warranty on hermetic scroll and semi-hermetic sealed compressors.

PART 2 - PRODUCTS

2.1 MATERIALS AND WORKMANSHIP

A. Stainless steel shall be type 302 or type 304 extra low carbon non-magnetic austenitic 18% chrome, 8% nickel alloy steel. Gauges shall be U.S. Standard of Thickness set forth below:

GAUGE	THICKNESS	GAUGE	THICKNESS
10	.1346	16	.0598
11	.1196	18	.0478
12	.1046	20	.0359
14	.0747	22	.0299

B. All sheets shall be of maximum length to permit fabrication from one sheet. All thickness must meet the above gauge thickness within tolerances set forth by the ANSI after polishing. Finished sheets exceeding these tolerances shall be rejected as not meeting this Specification.

C. Galvanealled steel shall be ARMCO steel or an approved grade of copper bearing steel shall be properly primed, degreased and finished with two coats of synthetic aluminum bronze.

D. Structural steel members used for framing, consisting of angles, bands, bars and channels shall be ductile in quality, free of hard spots, runs, checks, cracks and other surface defects and shall be smooth galvanized by the hot dip process with all surplus removed, free of runs, blisters, excess splatter and uncoated spots or patches.

E. White metal shall consist of corrosion resistant metal containing not less than 21% nickel. All castings shall be rough ground, polished and buffed to a bright luster and shall be free from pit marks, runs, checks, burrs and other imperfections.

F. Stainless steel pipe and tubing shall be seamless or welded of gauge specified and of true roundness. Seamless tubing shall be thoroughly and correctly annealed and ground smooth. Welded tubing shall be thoroughly heat treated and properly quenched to eliminate carbide precipitation, drawn true to size and roundness and polished to match stainless steel sheets.

G. Welding shall be of the electric submerged or concealed arc type, heliarc wherever practical. Where welding rods are required they shall be of the same composition as materials to be joined coated with a non-carbonaceous flux.

H. Plastic Laminate: Complying with NEMA LD 3 and NSF 35 requirements; NSF certified for end-use application indicated; 0.050 inch (1.27 mm) thick, smooth texture and easily cleanable.

1. Color: As selected by Architect from manufacturer's full range of colors.

I. Plywood and Lumber: Close grain exterior grade mahogany or birch plywood.

J. Sealant: ASTM C 920; Type S, Grade NS, Class 25, Use NT. Provide elastomeric sealant NSF certified for end-use application indicated. Provide sealant that when cured and washed meets requirements of Food and Drug Administration's 21 CFR, Section 177.2600 for use in areas that come in contact with food.

1. Color: As selected by Architect from manufacturer's full range of colors.
2. Backer Rod: Closed-cell polyethylene in diameter larger than joint width.

K. Plastic: Except for plastic laminate, provide plastic materials and components complying with NSF 51.

L. Sound Dampening: NSF-certified, non-absorbent, hard drying, sound-deadening coating. Provide coating compounded for permanent adhesion to metal in 1/8-inch (3-mm) thickness that does not chip, flake or blister.

M. Gaskets: NSF certified for end-use application indicated; of resilient rubber, neoprene or PVC that is nontoxic, stable, odorless, nonabsorbent and unaffected by exposure to foods and cleaning compounds.

2.2 ACCESSORIES

A. Cabinet Hardware: Provide NSF-certified stainless-steel hardware for equipment items as indicated.

B. Casters: NSF-certified standard-duty stainless-steel swivel stem casters with 5-inch (125-mm) diameter wheels, polyurethane tires with 1-inch (25-mm) tread width and 300-lb (90-kg) load capacity per caster. Provide brakes on 2 casters per unit.

2.3 FABRICATION, GENERAL

A. All welds shall be strong and ductile, nonporous, free of pits and cracks. Parts which are to be welded shall be homogeneous, of a like color and finish to adjoining material. Excess metal and carbide precipitation shall be ground off, finished smooth and polished. Unexposed welds shall be pacified to prevent attrition. Brazed or soldered joints are unacceptable. Where galvanizing has been damaged due to the welding or grinding process, these areas shall be galvawelded to replace finish

B. All exposed surfaces of the food service equipment shall be free from bolts, screws and rivet fastenings. Wherever bolts are required they shall be of similar composition and finish as the metal to which they are applied.

C. Wherever practical all food service equipment and fixtures shall be factory or shop fabricated of one-piece construction, shipped to the project site as one unit completely assembled.

D. Items of food service equipment or fixtures too large to enter or transverse the building to the installation location in one assembly shall be constructed in sections and shall be furnished with field joints. Where field joints are necessary, all adjoining exposed surfaces shall be field welded at the project site as specified above for welding. Where conditions make welded field joints impractical, each sub-assembly shall be fabricated with off-set draw angles welded to the underside of each adjoining top surface and drawn together to a “hairline” seam with 1/4"-20 stainless steel bolts with lock washers and chrome plated acorn nuts. Bolted field joints will be permitted only where specifically shown on Drawings or specified for a particular item.

E. Wherever shear edges occur they shall be free of burrs, fins or irregular projections and shall be finished to prevent cutting or laceration when the hand is drawn over such shear edges. Brake bends shall be free of undue and where such bends do mar the uniform surface appearance of the material, such marks shall be removed by suitable grinding, polishing and finishing. In no case where miters or bullnose corners occur is overlapping materials acceptable.

2.4 GENERAL FRABRICATION STANDARDS

A. TOPS:

1. Tops shall be fabricated of 14-gauge stainless steel unless otherwise specified. All edges shall be bullnose or formed as specified with all joints butt-edged and electrically welded, ground smooth and polished so no evidence of welding will appear. Soldered corners to achieve round corner construction will not be accepted.
2. Tops adjacent to walls, columns or other equipment shall be turned up integrally into a backsplash as specified. All interior corners shall be coved on a ¾” radius, both horizontally and vertically, forming spherical corners. Ends of backsplashes shall be fully enclosed to the low point of the top edge, fully welded, ground smooth and polished.

B. SUPPORT FRAMING

1. Around the entire perimeter on the underside of all tops and set back 1" from the down-turned edge shall be a fully welded frame assembly fabricated of 1-1/2" x 1-1/2" x 1/8" stainless steel angle iron or material as specified. Provide intermediate cross bracing fabricated of the same

material as the angle framing and fully weld to perimeter frame on centers not to exceed 24". Tack weld the entire frame assembly to the underside of the top surface.

2. Open base tables shall be provided with leg mounting channels for weld anchoring leg gussets and shall be fabricated of 1" x 4" x 1" 12-gauge stainless steel or material as specified fully welded at each end of frame and at intervals not to exceed 6'-0".
3. Cabinet base tables and counters shall be provided with triangular corner gusset plates for weld anchoring counter type legs and shall be fabricated of 12-gauge stainless steel fully welded at each corner of table or counter body and at intervals not to exceed 6'-0".
4. Freestanding sinks and Bain Maries shall be provided with triangular corner gusset plates for weld anchoring leg gussets and shall be fabricated of 12-gauge stainless steel, fully welded at each corner of sink or Bain Marie bottom and at intervals not to exceed 6'-0”.

C. LEGS AND ADJUSTABLE BULLET FEET

1. Legs shall be constructed of 1-5/8" diameter 16-gauge stainless steel tubing. Each leg shall be swaged and tapered at the bottom. Fasten each leg to a 3-1/2" high conical shaped die-formed stainless steel gusset equivalent to Component Hardware A20-0206. Provide each leg with stainless steel adjustable foot insert equivalent to Component Hardware A10-0852.
2. Cabinet base tables and counters shall be provided with 6" high conical shaped die-formed stainless steel equipment leg with stainless steel adjustable round foot insert equivalent to Component Hardware A72-0811.

D. CROSSRAILS

1. Provide all open base tables and freestanding sinks and bain Maries with 1-1/4" diameter 16-gauge stainless steel tubular cross railing running between legs at a point 10" above the finished floor. Cross railing shall be continuously welded to legs, filleted, ground smooth and polished to provide a smooth coved radius with leg surface.
2. Where cross railing abuts cabinet base fixtures, cross railing shall be concealed bolt anchored to same utilizing stainless-steel hardware.

E. UNDERSHELVES

1. Provide solid fixed undershelf, constructed of 16-gauge stainless steel. Front edge shall be turned down 1" at 90 degrees and returned ½” at 45 degrees. Rear and ends shall be turned up 2" high on a 90-degree angle, interior corners coved on ¾” radius.

F. DRAWERS

1. Provide drawer pan constructed of 14-gauge stainless steel with inside corners coved on a 3/4" radius. Drawer front face shall be double pan type constructed of 16-gauge stainless steel with inner pan set into outer pan and welded in place. Drawer front shall be set into and shall be removable from a 14-gauge stainless steel, channel shaped drawer cradle. Drawer suspension slides shall be secured to drawer frame assembly and shall be Component Hardware S52 series full extension type with 14-gauge stainless steel slides with stainless steel ball bearing wheels having a load capacity of 200 pounds. Provide hard rubber bumper drawer stops. Drawer suspension guides shall be fastened to 18-gauge stainless steel housing which is suspended from the angle framing under the table top. Provide drawer fronts with full grip recessed stainless steel flush pull handles.
2. Stainless steel drawer enclosure cabinet with quantity of drawers as specified with cabinet body fabricated of 18-gauge stainless steel, wrap around construction. The backs of front stiles shall be closed with tight fitting channel sections of 18-gauge stainless steel, welded in place, and closed on top and bottom. Drawer suspension slides shall be secured to drawer frame assembly and shall be Component Hardware S52 series full extension type with 14-gauge stainless steel slides with stainless steel ball bearing wheels having a load capacity of 200 pounds. Provide hard rubber

bumper drawer stops. Provide drawer fronts with full grip recessed stainless steel flush pull handles.

G. CABINET BASES

1. Cabinet body shall be fabricated of 18-gauge stainless steel wrap around construction. The backs of front stiles shall be closed with tight fitting channel sections of 18-gauge stainless steel, welded in place and closed on top and bottom.
2. Cabinet base shelves shall be fixed bottom and intermediate fabricated of 18-gauge stainless steel. Front edge shall be turned down 1 1/2" at 90 degrees, returned 1/2" at 90 degrees. Rear and ends shall be turned up 2" at 90 degrees with interior corners coved on a ¾" radius. Shelf shall be weld anchored to cabinet body. Bottom shelf shall be fabricated flush with front mullions with fully welded facing junctures presenting seamless construction. Fixed intermediate shelves shall be designed similar to bottom shelf except front edge shall be set behind vertical mullions and fully welded thereto.

H. SLIDING DOORS

1. Sliding doors shall be double pan type constructed of 16-gauge stainless steel with inner pan set into outer pan and welded in place. Doors shall have welded internally 1" x 4" x 1" 14-gauge stainless steel hat type reinforcing channels. Doors shall be fitted with full grip, recessed type stainless steel flush pull handles. Provide 16-gauge stainless steel angle door stops welded to door. Provide hard rubber door stops. Provide each door with two, 1 3/8" diameter stainless steel ball bearing sheaves fastened to 1" x 1/8" thick stainless-steel bar stock hangers welded to top corners of each door for suspending on overhead door channel track. Provide hangers with stainless steel removable locks to prevent doors from jumping track during operation while permitting ease of removal. Fabricate overhead track of 14-gauge stainless steel and weld to cabinet body. Provide bottom of doors with nylon door guides secured to bottom shelf. Guides shall not interfere with door removal.

I. HINGED DOORS

1. Hinged doors shall be double pan type constructed of 16-gauge stainless steel with inner pan set into outer pan and welded in place. Hinges shall be stainless steel cam action pin type fastened by means of counter sunk flat head stainless steel screws staggered on centers and tapped into 1/4" thick stainless-steel bar stock welded behind door jamb. Doors shall be removable from hinges without the use of tools. Doors shall be held closed by permanent magnet closure devices. Doors shall be fitted with a full grip recessed type stainless steel flush pull handle. Provide hard rubber door stop bumpers.

J. SINKS

1. Sinks shall be fabricated of 14-gauge stainless steel with all interior corners coved on a ¾" radius both horizontally and vertically forming spherical corners.
2. Exposed edges of sink shall be finished with a 1 ½" diameter 180 degree rolled edge, rear and sides adjacent to adjoining surfaces shall have a backsplash turned up 10" high at a 90-degree angle on a ¾" radius and turned back 2 ½" on a 45-degree angle, then down ½" at 90 degrees along back.
3. Multiple sink compartments shall be divided with double wall 14-gauge stainless steel partitions 1" wide rounded on top and all corners at a ¾" radius. Finish bottom, back and front with 14-gauge stainless steel to form one continuous sink with no overlapping joints or open spaces between sink compartments.
4. Integral drainboards shall be constructed of 14-gauge stainless steel. The front portion shall continue the 1 ½" diameter 180 degree rolled rim of the sink bowl on a continuous level horizontal plane. The surface of the drainboard shall be pitched from 2 ½" at the end away from the sink to 3" at the sink bowl. Sink and drainboard backsplash shall be continuous and level on the

horizontal plane. All interior corners both vertical and horizontal shall be coved on a ¾" radius. Drainboards shall be reinforced with 1" x 4" x 1", 12-gauge stainless steel "hat" channels extending front to rear tack welded to underside of drainboard for weld anchoring leg gussets.

5. Provide crossrails extending front to rear between legs, crossrails shall not extend along rear at sink to prevent interference with plumbing.
6. Built-in sink compartments shall be fabricated as an integral part of fixture with sink fully welded with adjacent top, weld ground smooth and polished.

K. MILLWORK

1. Millwork fabricator shop shall be a certified participant in AWI's Quality Certification Program (QCP) to standard "Premium" construction.
2. Tops shall be fabricated of 3/4" thick 5-7 ply BW marine grade plywood build up to a 1 ½" thickness. All plastic laminate finished edges shall be applied prior to the surface laminate. Provide cross bracing around entire perimeter below tops and above all interior dividers to minimize deflection from equipment. Tops shall be fabricated in sections as large as possible to minimize field seams. Field seams shall be assembled utilizing TB-2 yellow glue. The bottom surfaces of all tops must be sealed with gray cabinet liner to comply with Board of Health requirements. Cut-outs for drop-in equipment shall be cut in the shop and with all edges sealed. All drop-in equipment shall be pre-fitted in top prior to delivery to the job site. All drop-in equipment shall be sealed with General Electric or equivalent clear silicon sealer after installation. Hardwood edges shall be applied prior to surface laminate. All hardwood to match for color and grain. Edges to be chamfered and finished as specified. Solid surface tops shall receive full plywood substrate with 3/4" x 3" batons for proper air space. All tops shall be prepared for installation of sneeze guards including additional blocking and / or cutouts.
3. All cabinet base and interiors shall be fabricated of 3/4" thick 5-7 ply marine grade plywood with high-pressure laminate finish. Recessed toe base shall be 6" high fabricated of 3/4" thick 5-7 ply marine grade plywood with 16-gauge stainless steel finish. Shelf pilasters to be recessed type 250WH with 253WH locking clips. Cabinet backs shall be fabricated of 1/4" thick MELA-MDF board. Cabinet ends to be dadoed for back and bottom and notched to receive aprons and kicks. Butt or dowel construction will not be acceptable. Cabinets shall be assembled with TB-2 yellow glue with screws and staples. Cabinets with finished backs shall be fabricated of 3/4" thick 5-7 marine grade plywood with high-pressure laminate finish. Cabinets over 48" in length shall have interior dividers. Dividers shall be dadoed into the bottom and notched for aprons. Dividers shall be notched as required for equipment. Aprons shall be large enough to conceal drop-in equipment and also to house control panels. Cabinet bases shall be fabricated in sections as large as possible to minimize field seams.
4. Doors shall be fabricated of 3/4" thick MDF board with high-pressure laminate finish and shall be furnished with three BLUM 75M5580 or 75M5680 European style concealed hinges. Door pulls shall be Hafele 116.39.437. Locks where required shall be cam style, keyed alike. Doors shall not exceed 27" in width and shall be of equal size.
5. Drawers shall be constructed of 3/8" thick birchwood with dove tail joinery. Drawer slides shall be Accuride 150 lb. full extension type with stainless steel ball bearing hardware.
6. Applied wood fascia panels and doors shall be stile and rail design. Panels to be recessed or raised as specified. All wood to be select for color and grain. Finish shall match stock color samples or custom to match furnished sample. All panels and doors to be equally sized per cabinet. Provide full wood louvered panels as required for equipment requiring air circulation. Finish all wood with stain followed by single coat of sealer. After sealer, apply one layer of Armourcote conversion varnish approved for use in food service with 55% gloss.

L. SOLID AND HARD SURFACE MATERIAL ("CORIAN" / "ZODIAQ")

1. Provide counter top, tray slide, etc. of approved solid surface material. Material shall be fabricated and assembled per manufacturers approved methods utilizing a factory authorized and certified fabricator and installer. The edges of the top shall be formed as indicated on the food service and architectural detail drawings, routed and finished as directed. Openings shall have

radius corners and shall be reinforced with additional material. Where drop-in appliances are to set on tops, the fixture shall be furnished with a ¾" thick marine grade plywood sub-top fabricated with a perimeter frame extending through the opening in the top preventing the appliance from setting directly on the solid surface material and allowing the sub-top to distribute the weight of the appliance. Where heated appliances are to set on the top the sub-top is to be fabricated as above to prevent heat from being in direct contact with the solid surface top; additional fiberboard insulation material is to be provided where transfer of radiated heat will contact any solid surface material

M. PAINTING

1. Galvanized steel shall be cleaned and degreased with mineral spirits, primed with a minimum of two coats of primer and spray finished with a minimum of two coats of gray epoxy enamel paint

N. LAMINATED PLASTIC

1. All exposed surfaces shall be faced with 1/16" thick high-pressure plastic laminate in color and pattern as specified.
2. All unexposed surfaces shall be faced with .020 or .030 gray thermoset decorative overlay.
3. Where the plastic laminate is to be bonded to removable or fixed panels the panels shall be fabricated of 3/4" thick close grain marine grade mahogany or birch plywood with surfaces bonded with waterproof glue.
4. Where the plastic laminate is to be bonded directly to the metal facing of a cabinet base table or counter, surfaces shall be bonded with contact adhesive.

O. CLOSURE TRIM

1. Provide closure trim pieces fabricated of 16-gauge stainless steel or of material and finish as specified, trim shall be one-piece constructions furnished to seal both horizontal and vertical junctures and openings

2.5 STAINLESS STEEL FINISHES

A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal products" for recommendations relative to applying and designating finishes.

1. Remove or blend tool and die marks and stretch lines into finish.
2. Grind and polish surfaces to produce uniform directional textured polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

B. Concealed Surfaces: Minimum of 80 grit finish.

C. Exposed Surfaces: No. 4 finish (bright, directional polish) of 180 grit.

D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

E. Protect mechanical finishes on exposed surfaces from damage by applying a strippable temporary protective covering before shipment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions with Installer for compliance with requirements for installation tolerances, service-utility connections and other conditions affecting installation and performance of food service equipment. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Examine roughing-in for piping, mechanical and electrical systems to verify actual locations of connections before installation

3.2 INSTALLATION

A. Set each item of fixed food service equipment securely in place, level and adjust to correct height. Anchor to supporting surface where required for sustained operation and use without shifting or dislocation. Provide concealed anchoring where possible. Adjust work surfaces to a level tolerance of 1/16" maximum offset and slope drainage surfaces at 1/16" per foot.

B. Complete field assembly of field joints by welding or bolting utilizing the method as indicated with the fixture. Grind all field welds smooth and polish. Set and trim all gaskets to be installed as part of field assembly.

C. Treat enclosed spaces that are inaccessible after food service equipment installation by covering all horizontal surfaces with powdered borax at a rate of 4 ounces per square foot.

D. Provide closure trim pieces fabricated of 16-gauge stainless steel or of material and finish as specified, trim shall be one-piece construction furnished to seal both horizontal and vertical junctures and openings where the conditions given below occur:

1. Food service equipment is installed into wall openings. Trim shall apply to both sides of wall opening with all corners fully welded, ground smooth and polished.
2. Two or more items of food service equipment are butted together.
3. Food service equipment is installed against wall, columns other equipment resulting in a gap or juncture exceeding 1/4" in width.
4. An open gap of any size between the juncture or joint between adjoining items of food service equipment, wall or column surfaces which might result in the penetration or collection of grease or vermin.

E. Provide cut-outs and openings in food service equipment as required to extend plumbing, electric, steam or gas lines through the food service equipment either for interconnection of utility lines or final connection.

F. Seal around each item of food service equipment with sealant for gaps or spaces less than 1/4" in width and with stainless steel trim for gaps or spaces exceeding 1/4" in width. Closure strips shall conform to the shape and size of the surfaces or juncture to be sealed and shall be neatly scribed for a tight fit.

3.3 PROTECTION AND CLEANING

A. Provide final protection and maintain conditions in a manner acceptable to District, Manufacturer and Installer that ensure food service equipment is without damage or deterioration at the time of Substantial Completion.

B. After completion of the food service equipment installation and completion of other major work in the food service area remove protective coverings and clean and sanitize all food service equipment both internally and externally. Restore exposed and semi-exposed finished to remove abrasions or other surface damage, polish exposed metal surfaces and touch-up painted surfaces. Replace work which cannot be successfully restored.

3.4 COMMISIONING

A. Delay start-up of the food service equipment until utility services have been installed, completed and tested, balanced and adjusted for pressure and voltage, and until water and steam lines have been treated and cleaned for sanitation. Before start-up of the food service equipment lubricate in accordance with manufacturer's instructions.

1. Coordinate food service equipment startup with service-utility testing, balancing and adjustments. Do not operate steam lines before they have been cleaned and sanitized.

B. Provide on-site demonstration and formal technical training by the manufacturer's technical representative for each item of food service equipment as required to instruct the District and its personnel in the safe operation and sanitation and maintenance of the food service equipment.

C. Test each item of food service equipment for proper operation.

1. Repair or replace equipment that is defective in operation including units that operate below required capacity or that operate with excessive noise or vibration.
2. Test refrigeration equipment's ability to maintain specified operating temperature under heavy-use conditions. Repair or replace equipment that does not maintain specified operating temperature.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
4. Test motors and rotating equipment for proper rotation and lubricate moving parts according to manufacturer's written instructions.
5. Test water, drain, gas, steam, oil, refrigerant and liquid-carrying components for leaks. Repair or replace leaking components.
6. Train District's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing and preventive maintenance for each food service equipment item.
7. Review data in the operation and maintenance manuals. Refer to Division 1 Section "Contract Closeout".
8. Review data in the operation and maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data".
9. Schedule training with District through Construction Manager with at least seven days advance notice.

3.5 SCHEDULE OF EQUIPMENT

A. Equipment Schedule: Refer to all Contract Documents pertaining to the food service areas. Equipment itemized along with brands and model numbers and salient features establish the standard for construction, operation and engineering criteria.

B. Equipment indicated below is intended to establish the standard of quality of the food service equipment. Alternate "Equal" products by other manufacturers may be considered if equivalent in design, performance, durability and function.

C. This document is the intellectual property of Corsi Associates and as such use by any other entity is prohibited.

ITEM # 01	WALK-IN COOLER
Quantity:	One (1)
Manufacturer:	American Panel Corporation / Imperial Brown / Bally
Model:	175246A
Construction:	Size per the plan x 8’ – 6” high.

Furnish and erect one (1) compartment sectional urethane insulated walk-in cooler assembly.

Walk-in assembly shall bear the UL label and NSF and Factory Mutual seals and meet 2015 Federal Regulations.

Ceiling and wall panels shall be constructed of 4" thick urethane insulation, assembly to be accomplished by the use of integral cam type locking device secured in place during the foaming process. Seams between panels shall be fully insulated with vinyl foamed-in-place gasket material.

Ceiling and wall panels shall be finished of 18 gauge embossed aluminum on interior and exterior surfaces.

Walk-in assembly shall be provided with 1/8” thick aluminum diamond tread plate floor with NSF approved coved corners, insulated with 4" thick urethane insulation and reinforced with ¾” thick 5-7 ply marine grade plywood underlayment. Floor installation shall be in accordance with manufacturer’s recommended practice and shall sit in building floor depression. Building floor finish shall be flush and smooth to allow a level transition between the walk-in floor and the adjacent finished kitchen floor.

Walk-in assembly shall be furnished with (1) one 36” wide in-fitting type door and frame assemblies constructed of 16 gauge stainless steel provided with three self-closing cam action chrome plated hinge assemblies, handles and hardware.

Provide each door with 2" dial type flush mount thermometer with chrome plated bezel mounted in door frame.

Provide each door with triple pane observation and 36” high x 1/8” thick aluminum diamond tread kick plates on both interior and exterior side.

Provide each door with UL listed vapor-proof LED light fixture complete with glass globe, toggle switch and pilot light and full perimeter frame condensation heater.

Provide four (4) additional UL listed vapor-proof LED ceiling mounted light fixtures complete with stainless steel mounting hardware.

Food Service Equipment Contractor shall install ceiling mounted light fixtures and furnish materials and inter-wire light fixtures and switch.

Furnish and install 18 gauge embossed aluminum vertical trim angles and ceiling closure panels.

Furnish and install entire refrigeration system complete with hermetic condensing units and insulated copper refrigeration lines charged with R404A refrigerant. Each condensing unit shall be interconnected to a low profile, high velocity evaporator coil in each walk-in compartment. Refrigeration system shall include all fittings, valves, switches, controls and all related components to comprise a complete operating unit of sufficient BTU capacity to main-

tain automatic operation of 35 degree F product temperature in cooler and -10 degree F product temperature in freezer.

Refrigeration system shall be provided with outdoor remote air cooled condensing units located outdoors on building roof.

Condensing units shall be provided with winterized controls (low ambient package) including crankcase heater, line dryer, head pressure control, and galvanized steel stand with stainless steel weather hood.

Provide all hangers and brackets as required to install refrigeration lines.

Construction Trade shall furnish all sleeves and openings through walls for passage of refrigeration lines.

Roofing Trade shall provide waterproof roof opening for passage of refrigeration lines.

Food Service Equipment Contractor shall furnish and install copper tubing and extend evaporator coil condensate line to floor receptacle.

Set and adjust all temperature and defrost cycles.

Provide start-up and two year material and labor warranty on entire refrigeration system and five years manufacturer's warranty on compressor.

Refer to latest approved Engineering Drawings for engineering data and design methods and features which shall take precedence to this specification.

ITEM # 02	EVAPORATOR, WALK-IN COOLER
Quantity:	One (1)
Manufacturer:	American Panel Corporation / Imperial Brown / Bally
Model:	ADT156BK
Remarks:	Refer to latest approved Engineering Drawings for engineering data and design methods and features which shall take precedence to this specification.

ITEM # 03	CONDENSING UNIT, WALK-IN COOLER
Quantity:	One (1)
Manufacturer:	American Panel Corporation / Imperial Brown / Bally
Model:	FFAP-020Z-TC-072
Remarks:	Refer to latest approved Engineering Drawings for engineering data and design methods and features which shall take precedence to this specification.

ITEM # 04	WALK-IN FREEZER
Quantity:	One (1)
Manufacturer:	American Panel Corporation / Imperial Brown / Bally
Model:	175246B

Furnish and erect one (1) compartment sectional urethane insulated walk-in freezer assembly.

Walk-in assembly shall bear the UL label and NSF and Factory Mutual seals and meet 2015 Federal Regulations.

Ceiling and wall panels shall be constructed of 4" thick urethane insulation, assembly to be accomplished by the use of integral cam type locking device secured in place during the foaming process. Seams between panels shall be fully insulated with vinyl foamed-in-place gasket material.

Ceiling and wall panels shall be finished of 18 gauge embossed aluminum on interior and exterior surfaces.

Walk-in assembly shall be provided with 1/8” thick aluminum diamond tread plate floor with NSF approved coved corners, insulated with 4" thick urethane insulation and reinforced with ¾” thick 5-7 ply marine grade plywood underlayment. Floor installation shall be in accordance with manufacturer’s recommended practice and shall sit in building floor depression. Building floor finish shall be flush and smooth to allow a level transition between the walk-in floor and the adjacent finished kitchen floor.

Walk-in assembly shall be furnished with (1) one 36” wide in-fitting type door and frame assemblies constructed of 16 gauge stainless steel provided with three self-closing cam action chrome plated hinge assemblies, handles and hardware.

Provide each door with 2" dial type flush mount thermometer with chrome plated bezel mounted in door frame.

Provide each door with triple pane observation and 36” high x 1/8” thick aluminum diamond tread kick plates on both interior and exterior side.

Provide each door with UL listed vapor-proof LED light fixture complete with glass globe, toggle switch and pilot light and full perimeter frame condensation heater.

Provide four (4) additional UL listed vapor-proof LED ceiling mounted light fixtures complete with stainless steel mounting hardware.

Food Service Equipment Contractor shall install ceiling mounted light fixtures and furnish materials and inter-wire light fixtures and switch.

Walk-in freezer assembly shall be furnished with heated pressure relief port.

Furnish and install 18 gauge embossed aluminum vertical trim angles and ceiling closure panels.

Furnish and install entire refrigeration system complete with Copeland semi-hermetic condensing units and insulated copper refrigeration lines charged with R404A refrigerant. Each condensing unit shall be interconnected to a low profile, high velocity evaporator coil in each walk-in compartment. Refrigeration system shall include all fittings, valves, switches, controls and all related components to comprise a complete operating unit of sufficient BTU capacity to maintain automatic operation of 35 degree F product temperature in cooler and -10 degree F product temperature in freezer.

Refrigeration system shall be provided with outdoor remote air cooled condensing units located outdoors on building roof.

Condensing units shall be provided with winterized controls (low ambient package) including crankcase heater, line dryer, head pressure control, and galvanized steel stand with stainless steel weather hood.

Provide all hangers and brackets as required to install refrigeration lines.

Construction Trade shall furnish all sleeves and openings through walls for passage of refrigeration lines.

Roofing Trade shall provide waterproof roof opening for passage of refrigeration lines.

Food Service Equipment Contractor shall furnish materials and inter-wire defrost time clock circuit for walk-in freezer, from condensing unit to evaporator coil.

Food Service Equipment Contractor shall furnish materials and install (wrap and insulate with foam pipe insulation) heat tracing tape to evaporator coil condensate line in walk-in freezer.

Food Service Equipment Contractor shall furnish and install copper tubing and extend evaporator coil condensate line to floor receptacle.

Set and adjust all temperature and defrost cycles.

Provide start-up and two year material and labor warranty on entire refrigeration system and five years manufacturer's warranty on compressor.

Refer to latest approved Engineering Drawings for engineering data and design methods and features which shall take precedence to this specification.

ITEM # 05	EVAPORATOR, WALK-IN FREEZER
Quantity:	One (1)
Manufacturer:	American Panel Corporation / Imperial Brown / Bally
Model:	LET140BK
Remarks:	Refer to latest approved Engineering Drawings for engineering data and design methods and features which shall take precedence to this specification.

ITEM # 06	CONDENSING UNIT, WALK-IN FREEZER
Quantity:	One (1)
Manufacturer:	American Panel Corporation / Imperial Brown / Bally
Model:	FPAK-039Z-TFC-071
Remarks:	Refer to latest approved Engineering Drawings for engineering data and design methods and features which shall take precedence to this specification.

ITEM # 07 SPARE NO.

ITEM # 08	PLASTIC WITH METAL FRAME SHELVING
Quantity:	Six (6)
Manufacturer:	Metro / Nexel / Eagle
Model:	PR2460NK3
	Twenty-Four (24) Model PR2460NK3 Super Erecta Pro Shelf, 60"W x 24"D
	Twenty-Four (24)Model 70UPK3 Super Erecta SiteSelect Post
	Twenty-Four (24)Model 5MPB Super Erecta Stem Caster, brake (foot operated), 5"
Remarks:	Assemble in to four tier unit(s) with bottom shelf 12" above finished floor

ITEM # 09	PLASTIC WITH METAL FRAME SHELVING
Quantity:	Eight (8)
Manufacturer:	Metro / Nexel / Eagle
Model:	PR2448NK3
	Thirty-Two (32) Model PR2448NK3 Super Erecta Pro Shelf, 48"W x 24"D
	Thirty-Two (32) Model 70UPK3 Super Erecta SiteSelect Post
	Thirty-Two (32) Model 5MPB Super Erecta Stem Caster, brake (foot operated), 5"
Remarks:	Assemble in to four tier unit(s) with bottom shelf 12" above finished floor

ITEM # 10	PLASTIC WITH METAL FRAME SHELVING
Quantity:	Six (6)
Manufacturer:	Metro / Nexel / Eagle
Model:	PR2436NK3
	Twenty-Four (24)Model PR2436NK3 Super Erecta Pro Shelf, 36"W x 24"D

	Twenty-Four (24)Model 70UPK3 Super Erecta SiteSelect Post
	Twenty-Four (24)Model 5MPB Super Erecta Stem Caster, brake (foot operated), 5"
Remarks:	Assemble in to four tier unit(s) with bottom shelf 12” above finished floor

ITEM # 11	PLASTIC WITH METAL FRAME SHELVING
Quantity:	Two (2)
Manufacturer:	Metro / Nexel / Eagle
Model:	PR2442NK3
	Eight (8)Model PR2442NK3 Super Erecta Pro Shelf, 42"W x 24"D
	Eight (8)Model 70UPK3 Super Erecta SiteSelect Post
	Eight (8)Model 5MPB Super Erecta Stem Caster, brake (foot operated), 5"
Remarks:	Assemble in to four tier unit(s) with bottom shelf 12” above finished floor

ITEM # 12	PLASTIC WITH METAL FRAME SHELVING
Quantity:	Four (4)
Manufacturer:	Metro / Nexel / Eagle
Model:	PR2442NK3
	Twenty (20) Model PR2442NK3 Super Erecta Pro Shelf, 42"W x 24"D
	Sixteen (16) Model 86UPK3 Super Erecta SiteSelect Post, 85-7/8"H
	Sixteen (16) Model 5MPB Super Erecta Stem Caster, brake (foot operated), 5"
Remarks:	Assemble in to five tier unit(s) with bottom shelf 12” above finished floor

ITEM # 13	PLASTIC WITH METAL FRAME SHELVING
Quantity:	Fifteen (15)
Manufacturer:	Metro / Nexel / Eagle
Model:	PR2460NK3
	Seventy-Five (75) Model PR2460NK3 Super Erecta Pro Shelf, 60"W x 24"D
	Sixty (60) Model 86UPK3 Super Erecta SiteSelect Post, 85-7/8"H
	Sixty (60) Model 5MPB Super Erecta Stem Caster, brake (foot operated), 5"
Remarks:	Assemble in to five tier unit(s) with bottom shelf 12” above finished floor

ITEM # 14	HAND SINK
Quantity:	Five (5)
Manufacturer:	Select Stainless Products / Eagle / Advance Tabco
Model:	SHS-1
	Five (5) Wrist action handles
	Five (5) Rear, left and right side splashes
Remarks:	1. Food Service Equipment Contractor shall be responsible for providing and installing hollow masonry anchors and any other appropriate hardware to furnish support for installation.
	2. General Contractor shall furnish and install blocking in walls where needed to support installation.
	3. Food Service Equipment Contractor shall show blocking size, height and location, on shop drawings.
	4. District shall supply soap and towel dispensers.

ITEM # 15	SHELVING, WALL-MOUNTED
Quantity:	Two (2)
Manufacturer:	Select Stainless Products / Eagle / Advance Tabco
Model:	6WS-12 CUSTOM
Remarks:	MODIFY To 5'-6" Long as per FS-1.0
	1. Food Service Equipment Contractor shall be responsible for providing and installing hollow masonry anchors and any other appropriate hardware to furnish support for fully loaded shelf.
	2. General Contractor shall furnish and install blocking in walls where needed to support shelf.
	3. Food Service Equipment Contractor shall show blocking size, height and location, on

shop drawings.
4. Top of bottom shelf shall be installed approximately 4’-8” AFF and top of top shelf to be installed approximately 1’-0” above bottom shelf.

ITEM # 16	WORK TABLE
Quantity:	One (1)
Manufacturer:	Select Stainless Products / Eagle / Advance Tabco
Model:	9SUB-30-14 CUSTOM
	Two (2) Model B-1824 Weld-In Sink, one compartment, 18" wide x 24" front-to-back
	One (1) Model HF-12-D Heavy Duty Faucet, deck-mount, 8" centers, 12" long
	Two (2) Model 2-LDOF Twist Handle Lever drain, 2" drain outlet, with overflow
	Two (2) Model LDB Lever drain bracket
	One (1) Model FUS Fixed Undershelf, 18 gauge stainless steel
	One (1) Model 2020-DS-X Stainless steel drawer
Remarks:	MODIFY To 8'-6" Long as per FS-1.0

ITEM # 17	ELECTRIC FOOD CUTTER
Quantity:	One (1)
Manufacturer:	Hobart / Globe / Berkel
Model:	84186-16
	One (1) VS9PLT-ASP12 Slicing plate
Remarks:	Provide with standard accessories

ITEM # 18	WORK TABLE
Quantity:	One (1)
Manufacturer:	Select Stainless Products / Eagle / Advance Tabco
Model:	8SU-30-14
	One (1) Model FUS Fixed Undershelf, 18 gauge stainless steel
	Two (2) Model 2020-DS-X Stainless steel drawer

ITEM # 19	MEAT SLICER
Quantity:	One (1)
Manufacturer:	Hobart / Globe / Berkel
Model:	HS7N-1
Remarks:	One (1) Model HS-HEAVYGRIP Heavy Duty Meat Grip

ITEM # 20 SPARE NO.

ITEM # 21 SPARE NO.

ITEM # 22	WORK TABLE
Quantity:	One (1)
Manufacturer:	Select Stainless Products / Eagle / Advance Tabco
Model:	8SU-30-14
Remarks:	One (1) Model FUS Fixed Undershelf, 18 gauge stainless steel
	One (1) Model 8TMS-12 Overshelf, table mount, 96"W x 12"D x 18"H, single-deck
	Refer to FS-1.0 for shelf placement
	Two (2) Model 2020-DS-X Stainless steel drawer

ITEM # 23	REACH-IN REFRIGERATOR
Quantity:	Two (2)
Manufacturer:	Continental Refrigerator / True Refrigeration / Victory
Model:	DL1RE-SS
Remarks:	One (1) Model 50205-4 Casters, swivel, with brakes
	One (1) Model 50-P008AB-E Universal Pan Slide Assembly, half section universal slides
	Slides over shelves

Supply with field reversible doors

ITEM # 24	EXHAUST HOOD
Quantity:	One (1)
Manufacturer:	Caddy / Gaylord / Halton
Model:	PB-C-W-168-ND-72
Construction:	Furnish and install exhaust hood with integral plenum box make-air system.

Entire exhaust ventilation system shall be constructed in compliance with UL, NSF, NFPA, Factory Mutual, IMC 2015 (including automatic start-up of the exhaust and supply ventilation upon activation of any cooking appliance) and any prevailing statutes and codes.

Hood shall be 28’-0” long constructed in two equal sections of 18 gauge 304 stainless steel with all seams continuously welded, ground smooth and polished. Provide a full complement of stainless steel high efficiency solo baffle type grease extractors.

Furnish remote bulb thermostat with watertight hardware and install in either the exhaust plenum of the hood or in the exhaust duct. Provide NEMA 3 control panel box with hinged front cover complete with supply and exhaust fan contactors wired to an adjustable thermostat control, field wiring terminal strip and on-off switch.

Provide 18 gauge 304 stainless steel supply and exhaust duct collars.

Provide 18 gauge 304 stainless steel insulated supply air plenum box assembly along the face of the hood. Mount in finished ceiling along face of hood and furnish full length stainless steel perforated removable panels for discharge of supply air along entire face of hood.

Provide stainless steel threaded hanger rods complete with stainless steel mounting hardware for securing to structural ceiling.

Mechanical (HVAC) Trade shall furnish and install a complete exhaust air handling system including exhaust fan and controller, fan start-stop switch with status lights, 16 gauge insulated welded ductwork from exhaust collar on exhaust hood to fan, hinged roof curb with grease trough and removable grease container.

Mechanical (HVAC) Trade shall install exhaust hood heat detector(s) in exhaust hoods with multiple exhaust collars in the exhaust duct just after the point of the pant leg juncture; this includes punching of the required hole in the duct and installation of the heat detector and fitting.

Mechanical (HVAC) Trade shall furnish and install a complete supply air handling system including supply fan and controller (with maintainable filter system) and supply air heater with thermostat control (to temper incoming supply air below 65 degree F ambient), fan start-stop switch with indicator lights, galvanized steel ductwork from supply collar on exhaust hood to fan and roof curb.

Electrical Trade shall furnish and install interconnecting wiring between fan motors, controllers and switches.

Electrical Trade shall furnish and install inter-wiring of cooking appliance start-up inter-lock device and the supply and exhaust ventilation system and wire per the manufacturer’s instructions and per applicable codes.

Furnish UL listed vapor-proof recessed fluorescent light fixtures wired to a common on-off switch with stainless steel cover plate located on the wall adjacent to the exhaust ventilator.

Electrical Trade shall furnish materials and inter-wire light fixtures to wall switch.

Furnish and install 18 gauge stainless steel wall panels (insulated with 1” minimum thickness of mineral wool or equal if wall surface behind exhaust hood is less than 2 hour fire rated construction) extending from the bottom of the rear of the exhaust hood to the upper edge of the baseboard molding and extending along the full length of all wall surfaces. Wall panel sections shall be fitted with ½" wide off-set seams at intermediate joints to allow panel sections to fit tightly against the wall and to result in watertight seams. Secure wall panels to building wall with wall panel adhesive of proper type for wall construction. Seal end seams with General Electric or equivalent clear silicone sealer.

Refer to latest approved Engineering Drawings for engineering data and design methods and features which shall take precedence to this specification.

ITEM # 25	CONVECTION OVEN, GAS
Quantity:	Three (3)
Manufacturer:	Blodgett Oven / Garland / Vulcan
Model:	DFG-100 DBL
	Three (3) Dormont Model 1675KIT2S48PS Dormont Blue Hose Moveable Gas Connector Kit
	Three (3) Natural gas
	Three (3) Model SSD Top Oven: Solid State digital with Pulse Plus and Cook & Hold
	Three (3) Model SSD Bottom Oven: Solid State digital with Pulse Plus and Cook & Hold
	Three (3) Draft diverter
	Six (6) Stainless steel interior liners
	Six (6) Side shields, right hand side only, per deck
	Three (3) Casters set
	Three (3) Gas manifolds
	Three (3) Gas pressure regulator
	Three (3) Dormont 1675KITCF2S-48 gas hose kit
Sup Info:	Food Service Equipment Contractor shall install disconnect at wall connection and to cooking appliance per manufacturer’s instructions.

ITEM # 26	CONVECTION STEAMER, GAS
Quantity:	Two (2)
Manufacturer:	Cleveland Range / Groen / Vulcan
Model:	24CGA10.2
Remarks:	Two (2) Dormont Model 1675KIT2S48PS Dormont Blue Hose Moveable Gas Connector Kit
	Four (4) Dormont Model W50BP2Q48 Dormont Hi-PSI Water Connector Hose, 1/2" dia
	Two (2) Performance start-up included
	Two (2) Natural Gas
	Two (2) (VOS115)
	Two (2) Model 113717 10 pan heat shield
	Two (2) Model DISSOLVE (PN 106174) Descaling Solution,
	Two (2) Model BDPK1 Boiler Descaling Pump Kit
	Two (2) Gas pressure regulator
	Two (2) Dormont 1675KITCF2S-48 gas hose kit
Sup Info:	Food Service Equipment Contractor shall install disconnect at wall connection and to cooking appliance per manufacturer’s instructions.

ITEM #26F	WATER FILTRATION, STEAMER
Quantity:	One (1)
Manufacturer:	Everpure / 3M / Optipure
Model:	EV979722
Options:	EV961250 Pre-filter cartridge

Sup Info: Furnish stainless steel mounting hardware of proper type for wall construction and to sustain weight while in use.

General contractor shall provide wall blocking as required for mounting.

Food Service Equipment Contractor shall install steamer filter system in water supply line and furnish and install interconnecting piping between water filter and steamer water inlet.

ITEM # 27 FLOOR TROUGH
Quantity: One (1)
Manufacturer: Select Stainless Products / Eagle / Advance Tabco
Model: 2FT-30
Sup Info: Construction Trade shall provide floor recess and install floor pan in recess flush with adjacent kitchen floor in a watertight manner.

ITEM # 28 TILTING SKILLET BRAISING PAN, GAS
Quantity: One (1)
Manufacturer: Cleveland Range / Groen / Vulcan
Model: SGL40T1
Remarks:
One (1) Dormont Model 1675KIT2S48PS Dormont Blue Hose Moveable Gas Connector Kit
Two (2) Dormont Model W50BP2Q48 Dormont Hi-PSI Water Connector Hose, 1/2" dia
One (1) Natural Gas
One (1) Model PT2 Power Tilt, with hand tilt override
One (1) Model TD2SK 2" tangent draw-off valve, front mounted left side
One (1) Model TDDC Drain Cup Assembly
One (1) Model PCS Pan Carrier
One (1) Model B0176 T & S Double Pantry Faucet with spout & spray hose combination
One (1) Model FBST1 Faucet Bracket
One (1) Gas pressure regulator
Sup Info: Food Service Equipment Contractor shall install disconnect at wall connection and to cooking appliance per manufacturer’s instructions.

ITEM # 29 FLOOR TROUGH
Quantity: One (1)
Manufacturer: Select Stainless Products / Eagle / Advance Tabco
Model: 2FT-30
Sup Info: Construction Trade shall provide floor recess and install floor pan in recess flush with adjacent kitchen floor in a watertight manner.

ITEM # 30 SPARE NO.

ITEM # 31 SPARE NO.

ITEM # 32 KETTLE, GAS, TILTING
Quantity: One (1)
Manufacturer: Cleveland Range / Groen / Vulcan
Model: KGL40TSH
Remarks:
One (1) Dormont Model 1675KIT2S48PS Dormont Blue Hose Moveable Gas Connector Kit
Two (2) Dormont Model W50BP2Q48 Dormont Hi-PSI Water Connector Hose, 1/2" dia
One (1) Performance start-up included
One (1) Natural Gas
One (1) Electronic spark ignition, cord & plug for controls
One (1) Model TD2 2" tangent draw-off valve with strainer
One (1) Model TDDC Drain Cup Assembly, includes: 8' length of 2" ID hose
One (1) Model 316G2 316 stainless steel liner, for 60 - 100 gallons, per each kettle
One (1) Model KM2G Kettle Markings, 5 gallon increments

One (1) Model FS40 Food Strainer, 40 gallon, stainless steel
One (1) Model CHS40GTSH Spring-assisted cover (40 gallon)
One (1) Model DPKT Double Pantry Faucet, with swing spout & mounting
One (1) Model PCK Pan Carrier, for all floor model kettles 25 gal & larger
One (1) Model HS001 Heat Deflector
One (1) Model KAK Kettle Accessory Kit including clean up brush, paddle, stainless steel whip, brush, draw-off brush, ladle
One (1) Gas pressure regulator

Sup Info: Food Service Equipment Contractor shall install disconnect at wall connection and to cooking appliance per manufacturer's instructions.

ITEM # 33 WORK TABLE
Quantity: One (1)
Manufacturer: Select Stainless Products / Eagle / Advance Tabco
Model: 5SUB-30-14
Remarks: One (1) Model FUS Fixed Undershelf, 18 gauge stainless steel
One (1) Model 2020-DS-X Stainless steel drawer

ITEM # 34 SHELVING, WALL-MOUNTED
Quantity: Two (2)
Manufacturer: Select Stainless Products / Eagle / Advance Tabco
Model: 5WS-12
Remarks:
1. Food Service Equipment Contractor shall be responsible for providing and installing hollow masonry anchors and any other appropriate hardware to furnish support for fully loaded shelf.
2. General Contractor shall furnish and install blocking in walls where needed to support shelf.
3. Food Service Equipment Contractor shall show blocking size, height and location, on shop drawings.
4. Top of bottom shelf shall be installed approximately 4'-8" AFF and top of top shelf to be installed approximately 1'-0" above bottom shelf.

ITEM # 35 ROLL-THRU REFRIGERATOR
Quantity: Two (2)
Manufacturer: Continental Refrigerator / True Refrigeration / Victory
Model: DL1RI-SS-RT
Remarks: Supply with field reversible doors

ITEM # 36 REFRIGERATOR RACK, ROLL-IN
Quantity: Six (6)
Manufacturer: Metro / Channel / New Age
Model: RF3N
Remarks: Four (4) Model A37 Mobile Tray Rack Corner Bumper Set

ITEM # 37 ROLL-THRU HEATED CABINET
Quantity: Three (3)
Manufacturer: Continental Refrigerator / True Refrigeration / Victory
Model: DL1WI-SS-RT
Remarks: Supply with field reversible doors

ITEM # 38 WORK TABLE
Quantity: One (1)
Manufacturer: Select Stainless Products / Eagle / Advance Tabco
Model: 4SL-30-14-CUSTOM
Remarks: Modify length to 3'-6"
One (1) Model 2020-DS-X Stainless steel drawer

ITEM # 39 SPARE NO.

ITEM # 40 SPARE NO.

ITEM # 41 SPARE NO.

ITEM # 42 WORK TABLE
Quantity: One (1)
Manufacturer: Select Stainless Products / Eagle / Advance Tabco
Model: 7SU-30-14
One (1) Model B-2020 Weld-In Sink, one compartment, 20" x 20" x 12" deep
One (1) Model HF-8-D Heavy Duty Faucet, deck-mount
One (1) Model 2-LDOF Twist Handle Lever drain, 2" drain outlet, with overflow
One (1) Model LDB Lever drain bracket
One (1) Model FUS Fixed Undershelf, 18 gauge stainless steel

ITEM # 43 POWER WASH SINK
Quantity: One (1)
Manufacturer: Unified Brands / Champion / Duke
Model: 2044869 Custom

ITEM # 44 POT RACK
Quantity: One (1)
Manufacturer: Select Stainless Products / Eagle / Advance Tabco
Model: 10DPR-S
Remarks:
1. Food Service Equipment Contractor shall be responsible for providing and installing hollow masonry anchors and any other appropriate hardware to furnish support for fully loaded shelf.
2. General Contractor shall furnish and install blocking in walls where needed to support shelf.
3. Food Service Equipment Contractor shall show blocking size, height and location, on shop drawings.
4. Top of bottom shelf shall be installed approximately 4’-8” AFF

ITEM # 45 MILK COOLER
Quantity: Three (3)
Manufacturer: Continental Refrigerator / True Refrigeration / Victory
Model: MC3-SS-D
Remarks: Three (3) Model 45249CP Thermometer Digital Reading, externally mounted
Three (3) Model 50182 Foot Pedal, floor lock
Three (3) Model 5-222 Corner bumpers

ITEM # 46 SNEEZE GUARD, STATIONARY
Quantity: Three (3)
Manufacturer: BSI / Premier Brass / English
Model: ZG9930
Remarks: Three (3) Stainless steel tubing, posts and framing
Three (3) 3/8" Tempered glass
Three (3) End panel
Three (3) Model 2580 Slimline Light
Three (3) Model 3000K LED Lamp
Three (3) Model SSU5-H Stainless Steel Undercounter Mount, heavy duty

ITEM # 47 SERVING COUNTER, COLD FOOD
Quantity: Three (3)

Manufacturer: Low Temp Industries / Duke Mfg. / Piper Products
Model: 50-CFT
Remarks: Three (3) NEMA 5-15P
Three (3) Stainless steel
Three (3) (MM) Vertical trim strip
Three (3) Corian tray slide with (3) inverted "V" ridges on surface, stainless steel
Three (3) (AA) Line up lock
Three (3) 4" Casters
Unit(s) to have Open Base on Employee Side
Verify all finish and surface selections with Architect and District

ITEM # 48 SERVING COUNTER, UTILITY
Quantity: Three (3)
Manufacturer: Low Temp Industries / Duke Mfg. / Piper Products
Model: 28-ST CUSTOM
Remarks: Three (3) Stainless steel
Three (3) (MM) Vertical trim strip
Three (3) Corian tray slide with (3) inverted "V" ridges on surface, stainless steel
Three (3) (AA) Line up lock
Three (3) 4" Casters
Unit(s) to have Open Base on Employee Side
Verify all finish and surface selections with Architect and Owner and District

ITEM # 49 SERVING COUNTER, UTILITY
Quantity: Three (3)
Manufacturer: Low Temp Industries / Duke Mfg. / Piper Products
Model: 28-ST CUSTOM
Remarks: Three (3) Stainless steel
Three (3) (MM) Vertical trim strip
Three (3) (AA) Line up lock
Three (3) 4" Casters
Unit(s) to have Open Base on Employee Side
Verify all finish and surface selections with Architect and Owner and District

ITEM # 49.1 DROP-IN HEATED GLASS SHELF
Quantity: Three (3)
Manufacturer: Low Temp Industries / Duke Mfg. / Piper Products
Model: GHT-28
Remarks: Unit(s) to be installed in serving counter #49

ITEM # 50 SPARE NO.

ITEM # 51 SPARE NO.

ITEM # 52 SERVING COUNTER, HOT FOOD, ELECTRIC
Quantity: Three (3)
Manufacturer: Low Temp Industries / Duke Mfg. / Piper Products
Model: EF4-CPA
Remarks: Three (3) NEMA 5-30P
Three (3) Model AUTO FILL
Three (3) Stainless steel
Three (3) (MM) Vertical trim strip
Three (3) (Z) Hot food drains
Three (3) (AA) Line up lock
Three (3) Corian tray slide with (3) inverted "V" ridges on surface, stainless steel
Three (3) (E) Cutting board, Richlite

Three (3) 4" Casters
Unit(s) to have Open Base on Employee Side
Verify all finish and surface selections with Architect and Owner and District

ITEM # 53 SNEEZE GUARD, STATIONARY
Quantity: Three (3)
Manufacturer: BSI / Premier Brass / English
Model: ZG9930
Remarks: Custom size as per plan
Three (3) Stainless steel tubing, posts and framing
Three (3) 3/8" Tempered glass
Three (3) End panel
Three (3) Model 605 Stealth Warmer & Light Combo
Three (3) Model 3000K LED Lamp
Three (3) Remote Infinite
Three (3) Model SSU5-H Stainless Steel Undercounter Mount, heavy duty

ITEM # 54 POS - N.I.C. - BY OTHERS
Quantity: Three (3)
Sup Info: Not in Foodservice Equipment contract, furnished by the District.

ITEM # 55 CASH REGISTER STAND
Quantity: Three (3)
Manufacturer: Low Temp Industries / Duke Mfg. / Piper Products
Model: 36-CSS
Remarks: Three (3) Molded fiberglass
Three (3) (MM) Vertical trim strip
Three (3) (AA) Line up lock
Three (3) 3" Knock-out on top
Three (3) (HH) Locking cash drawer
Three (3) Corian tray slide with (3) inverted "V" ridges on surface, stainless steel
Three (3) 4" Casters
Verify all finish and surface selections with Architect and Owner and District

ITEM # 56 ICE CUBER
Quantity: One (1)
Manufacturer: Hoshizaki / Manitowoc / Ice-o-Matic
Model: KM-1100MAH
Sup Info: Food Service Equipment Contractor shall install ice machine filter system in water supply line and furnish and install interconnecting piping between water filter and ice machine water inlet.

ITEM # 57 WATER FILTRATION SYSTEM FOR ICE CUBER
Quantity: One (1)
Manufacturer: Everpure / 3M / Optipure
Model: EV932504
Remarks: One (1) Model EV932504 INSURICE Quad i4000² System
One (1) Model EV961232 I4000² Replacement Cartridge
Sup Info: Furnish stainless steel mounting hardware of proper type for wall construction and to sustain weight while in use.

General contractor shall provide wall blocking as required for mounting.

Food Service Equipment Contractor shall install ice maker filter system in water supply line and furnish and install interconnecting piping between water filter and ice maker water inlet.

ITEM # 58	ICE BIN FOR ICE MACHINES
Quantity:	One (1)
Manufacturer:	Hoshizaki / Manitowoc / Ice-o-Matic
Model:	B-900SF
	One (1) Model HS-2035/HS-2033 Top Kits, 30
	One (1) Model LP-6 LEG Leg Package, (4) x 6" stainless steel legs
	One (1) Ice Scoop and holder
ITEM # 59	FLOOR TROUGH
Quantity:	One (1)
Manufacturer:	Select Stainless Products / Eagle / Advance Tabco
Model:	4FT-12
Sup Info:	Construction Trade shall provide floor recess and install floor pan in recess flush with adjacent kitchen floor in a watertight manner.
ITEM # 60	SPARE NO.
ITEM # 61	SPARE NO.
ITEM # 62	MOP SINK
Quantity:	One (1)
Manufacturer:	Select Stainless Products / Eagle / Advance Tabco
Model:	MS-2028-12
Remarks:	One (1) Model 18-MH Mop Holder
	One (1) Model 2WS-10-MH Wall Shelf
	One (1) Model 8-MF Service Faucet
Sup Info:	Furnish stainless steel mounting hardware of proper type for wall construction and to sustain weight while in use.
	General contractor shall provide wall blocking as required for mounting.
ITEM # 63	WASHER/DRYER COMBO - N.I.C. - BY OTHERS
Quantity:	One (1)
Sup Info:	Not in Foodservice Equipment contract, furnished by the District.
ITEM # 64	PLASTIC WITH METAL FRAME SHELVING
Quantity:	Three (3)
Manufacturer:	Metro / Nexel / Eagle
Model:	PR2436NK3
Remarks:	Twelve (12) Model PR2436NK3 Super Erecta Pro Shelf, 36"W x 24"D
	Twelve (12) Model 86UPK3 Super Erecta SiteSelect Post
	Twelve (12) Model 5MPB Super Erecta Stem Caster, brake (foot operated), 5"
	Assemble in to five tier unit(s) with bottom shelf 12” above finished floor
ITEM # 65	FIRE PROTECTION REMOTE CABINET
Quantity:	One (1)
Manufacturer:	Ansul Fire Protection
Model:	R-102
Sup Info:	Furnish and install in exhaust hood, plenum and surface fire protection system.
	Entire system shall be furnished and installed in compliance with UL, NSF, NFPA, Factory Mutual, IMC 2009 and any prevailing statutes or codes including automatic shut-down of all cooking appliances per code section 44 of NFPA 17-27.
	Furnish and install in exhaust hood as part of fire system, mechanically operated fusible link temperature detection system to activate entire fire system in event of

fire.

All piping and nozzles of fire system shall be factory installed in exhaust hood, exposed piping, nozzles and fittings shall be chrome plated.

Inter-wiring of the fire system to the exhaust hood shall be furnished and installed by the Electrical Trade.

Provide as part of fire system, mechanically operated gas supply line shut-off valve to interrupt gas supply to all gas operated cooking appliances. Gas valve shall be provided with manual reset to prevent gas flow to pilot devices on appliances prior to restart.

Provide one remote manual pull station to actuate fire system in the event of a fire.

Plumbing Trade shall install gas shut-off valve in gas supply line.

Electrical Trade shall furnish and install electric shunt-trip circuit breakers or electric shut-off contactors to interrupt electric power to all electrically operated cooking appliances.

Provide dry contacts in fire system to interface with building fire alarm system as required, electrical tie-in shall be the responsibility of the Electrical Trade.

Provide as part of fire system, start-up testing of the fire system as required by local fire codes. Subsequent testing of the fire system for a period of one year after start-up shall be included as part of this contract.

Refer to latest approved Engineering Drawings for engineering data and design methods and features which shall take precedence to this specification.

END OF SECTION

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SECTION 11 52 13
PROJECTION SCREENS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Front projection screen assemblies - electric.

B. Motorized projector lifts

1.02 RELATED REQUIREMENTS

A. Section 05 50 00 - Metal Fabrications: Supports for suspended projection screens.

B. Section 09 51 00 - Acoustical Ceilings: Suspended panel ceilings for recessed screens.

1.03 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Product Data: Manufacturer's catalog cuts and descriptive information on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
   4. Wiring diagrams for motor operators and actuators, and controls and switches.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

C. Motors for projector lifts shall be certified for use in the United States by Underwriters Laboratory (UL), Inc. and shall bear UL label.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver projection screens to project site in manufacturer's original unopened packaging, and inspect for damage and proper size before accepting delivery.

B. Deliver motorized projector lifts in manufacturer’s original, unopened, undamaged containers with identification labels intact.

C. Inspect motorized projector lifts for freight damage, concealed or otherwise, upon delivery to project site. Report damage to freight carrier immediately for replacement of motorized projector lifts.

D. Store in a protected, clean, dry area with temperature maintained above 50 degrees F, and stack in accordance with manufacturer's recommendations.

E. Acclimate screens to building temperatures for 24 hours prior to installation, in accordance with manufacturer's recommendations.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Da-Lite Screen Company: www.da-lite.com.

B. Draper, Inc; Access Fit E: www.draperinc.com/#sle.

C. Stewart Filmscreen Corporation: www.stewartfilmscreen.com.

D. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 FRONT PROJECTION SCREENS

A. Basis of Design : Draper, Inc: Access Fit E
   1. Description: Electric motor operated, steel case. Ceiling-recessed, 18-gauge steel headbox, 5-11/16 inches high and 4-7/8 inches wide (7-3/4 inches including flanges) with white paint finish and stamped 13-gauge steel end caps.
   2. Dimensions & Data:
      a. Viewing Area H x W
         1) HDTV Format (16:9). Black masking borders standard.
         2) 133 inch diagonal, 65 inches x 116 inches.
         3) Overall Size: 69 inches high x 120 inches wide
      b. Weight: 87 lbs
   3. Motor mounted inside screen roller on rubber isolation insulators. Motor UL certified, rated 110-120V AC, 60 Hz, three wire, instantly reversible, lifetime lubricated with pre-set accessible limit switches.
   4. Motor Screen Controls, UL certified.
      a. Single station control rated 115V AC, 60 Hz with 3-position rocker switch with cover plate to stop or reverse screen at
   5. Projection Viewing Surface
      a. Contrast Grey XH800E - 0.8 On Axis gain. Smooth grey surface provides excellent resolution and enhances color contrast. 180 degree viewing cone. GREENGUARD Gold certified.
   6. Provide an extra screen drop with an overall screen drop of 4 inches with a black masking top border.

B. Provide mounting hardware, brackets, supports, fasteners, and other mounting accessories required for a complete installation, in accordance with manufacturer's recommendations for specified substrates and mountings.

2.03 MOTORIZED PROJECTOR LIFT

A. Electrically Operated, Low Profile Lifts: Electrically operated, ceiling recessed projector lift for lowering and retracting projector for operation and storage. Assembly to include controls, mounting hardware, wiring, and other components required for complete operation.

B. Basis-of-Design Product: Draper, Inc.: AeroLift 35
   1. Limit Switches: Provide factory set and field adjustable.
   2. Maximum Extension: 24.5 inches
   3. Maximum Lift Capacity: 35 lbs
   4. Approximate Travel Speed: 15 seconds
   5. Operating Mechanism: Operating pan raised and lowered by 110 VAC, 60 HZ, instantly reversible, thermally protected, lifetime lubricated, tubular 3-wire motor and cloth system with scissor arm for stability.
      a. Operating Pan: 20 inches x 12-1/2 inches
   6. Projector Attachment: Mounted to operating pan with universal projector mount.
      a. Universal Projector Mount: Universal bracket suitable for projectors up to 26 lbs with adjustable arms that can be manipulated to fit most projectors with three or four

mounting holes. Tilt, yaw and pan adjustments can be made quickly using spring-loaded bolts.

b. Basis-of-Design Product: Universal Projector Mount as manufactured by Draper, Inc.

7. Ceiling Closure Panel: Steel closure panel with ceiling tile lip, suspended below projector from rods attached to operating pan. Closure mounted flush with adjacent ceiling surface and finished with powder coat paint finish
   a. Trim: Metal trim ring to finish ceiling opening.
   b. Color: White powder coat.
   c. Size: Large AeroLift 35 Closure, 25 inches x 25 inches
8. Controls:
   a. Provide 1control stations to lower, raise, and stop projector lift.
   b. Single Station Control: 3-position 110-120V maintained rocker switch with [stainless steel cover plate and black rocker]

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrate is finished and ready to accept screen installation.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Verify that openings for recessed screens are correctly sized.

D. Do not install projection screens until climate control systems are in place and interior painting and other finishes are completed.

3.02 PREPARATION

A. Coordinate screen installation with installation of projection systems.

B. Coordinate installation with adjacent construction and fixtures, including ceilings, walls, lighting, fire suppression, and registers and grilles.

C. Coordinate layout and installation of motorized projector lifts with ceiling construction and related components penetrating or above ceilings such as lighting fixtures, mechanical equipment, ductwork, and fire-suppression system.

D. Coordinate requirements for blocking, structural supports, bracing, and ceiling openings to ensure proper installation of motorized projector lifts.

E. Coordinate location and requirements for power supply conduit, and wiring required for motorized projector lifts and controls.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions, using manufacturer's recommended hardware for relevant substrates.

B. Do not field cut screens.

C. Install screens in mountings as specified and as indicated on drawings.

D. Install plumb and level.

E. Adjust projection screens and related hardware in accordance with manufacturer's instructions for proper placement and operation.

F. Test electrical screens for proper working condition. Adjust as needed.

G. Install motorized projector lifts complete with necessary hardware, anchors, brackets and fasteners; according to manufacturer's written instructions and as specified.

3.04 PROTECTION

A. Protect installed products until completion of project.

B. Touch up, repair, or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 11 66 23
GYMNASIUM EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Basketball backboards.

B. Floor sleeves for net and goal posts.

C. Wall mounted protection pads.

1.02 REFERENCE STANDARDS

A. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015 (with March 2016 Errata).

1.03 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Product Data: Provide manufacturer's data showing configuration, sizes, materials, finishes, hardware, and accessories; include:
   1. Structural steel welder certifications.
   2. Manufacturer's installation instructions.

C. Samples: Submit samples of wall pad coverings in manufacturer's available range of colors.

D. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified with minimum 3 years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to project site in manufacturer's original packaging with factory original labels attached.

B. Store products indoors and elevated above floor; prevent warping, twisting, or sagging.

C. Store products in accordance with manufacturer's instructions; protect from extremes of weather, temperature, moisture, and other damage.

1.06 WARRANTY

A. See Section 01 77 00 - Closeout Procedures, for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Gymnasium Equipment:
   1. Draper, Inc: www.draperinc.com/#sle.
   2. IPI by Bison, Inc: www.ipibybison.com/#sle.
   3. Porter Athletic Equipment Company: www.porterathletic.com.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 GENERAL REQUIREMENTS

A. See drawings for sizes and locations, unless noted otherwise.

B. Provide mounting plates, brackets, and anchors of sufficient size and strength to securely attach equipment to building structure; comply with requirements of contract documents.

C. Hardware: Heavy duty steel hardware, as recommended by manufacturer.

D. Structural Steel Fabrications: Welded in accordance with AWS D1.1/D1.1M, using certified welders.

2.03 BASKETBALL

A. Backboards: Tempered glass, rectangular shaped.
   1. Frame: Brushed aluminum edge, steel mounting.
   2. Markings: Painted.
   3. Color: Manufacturer's standard.

2.04 FLOOR-MOUNTED EQUIPMENT

A. Floor Sleeves for Posts: Metal sleeve, with latch cover, cast into concrete subfloor to hold poles for nets and goals; installed flush with finish floor surface.
   1. Latch Cover: Brass, round; tamper resistant lock with key.
   2. Sleeve: Aluminum.
   3. Depth of Sleeve: 9 inches from floor surface to bottom, including latch cover.

2.05 WALL PADDING

A. Wall Padding: Foam filling bonded to backing board, wrapped in covering; each panel fabricated in one piece.
   1. Provide
   2. Covering: Vinyl-coated polyester fabric, mildew and rot resistant; stapled to back of board.
      a. Color: As selected from manufacturer's standard range.
      b. Texture: Embossed leather-look.
      c. Fabric Weight: 14 oz/sq yd.
   3. Foam: Urethane, soft, 3.5 pcf nominal density.
   4. Foam: Open cell polychloroprene (Neoprene) 5.5 pcf nominal density.
   5. Foam Thickness: 2 inches.
   6. Backing Board: Plywood.
   7. Mounting: Permanent; using screws.

PART 3 EXECUTION

3.01 EXAMINATION

A. Take field measurements to ensure proper fitting of work. If taking field measurements before fabrication will delay work, allow for adjustments within recommended tolerances.

B. Inspect areas and conditions before installation, and notify Architect in writing of unsatisfactory or detrimental conditions.

C. Do not proceed with this work until conditions have been corrected; commencing installation constitutes acceptance of work site conditions.

3.02 INSTALLATION

A. Install in accordance with contract documents and manufacturer's instructions.

B. Coordinate installation of inserts and anchors that must be built in to flooring or subflooring.

C. Install equipment rigid, straight, plumb, and level.

D. Secure equipment with manufacturer's recommended anchoring devices.

E. Install wall padding securely, with edges tight to wall and without wrinkles in fabric covering.

F. Separate dissimilar metals to prevent electrolytic corrosion.

3.03 ADJUSTING

A. Verify proper placement of equipment.

B. Verify proper placement of equipment anchors and sleeves, and use actual movable equipment to be anchored if available.

3.04 CLEANING

A. Remove masking or protective covering from finished surfaces.

B. Clean equipment in accordance with manufacturer's recommendations.

3.05 PROTECTION

A. Protect installed products until Date of Substantial Completion.

B. Replace damaged products before Date of Substantial Completion.

END OF SECTION

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SECTION 12 34 00
LAMINATE CLAD CASEWORK

PART 1 – GENERAL

1.01 SECTION INCLUDES

A. Fixed modular laminate clad casework and components.

B. Countertops.

1.02 RELATED SECTIONS

A. Section 01 74 19 – Construction Waste Management.

B. Section 01 81 13 – Sustainable Design Requirements.

C. Section 01 81 14 – Volatile Organic Compound (VOC) Limits For Adhesives, Sealants, Paints & Coatings.

D. Section 01 81 19 – Indoor Air Quality Requirements.

E. Section 061000: Blocking within walls where indicated.

F. Section 09 6500 - Resilient Flooring: Base molding.

G. Section 12 36 00: Countertops

H. Division 15: Service fixtures, service waste lines, connections, and vents.

I. Division 16: Electrical service fixtures.

1.03 LEED REQUIREMENTS

A. LEED Focus Materials (LFMs) For This Section
   1. Targeted products containing Recycled Content (MRc4)
   2. Targeted products containing Regional Material (MRc5)
   3. Targeted products to meet Composite Wood & Agrifiber requirements (EQc4.4)

1.04 DEFINITIONS

A. Identification of casework components and related products by surface visibility.
   1. Open Interiors: Any open storage unit without solid door or drawer fronts, units with full glass insert doors and/or acrylic doors, and units with sliding solid doors.
   2. Closed Interiors: Any closed storage unit behind solid door or drawer fronts.
   3. Exposed Ends: Any storage unit exterior side surface that is visible after installation.
   4. Other Exposed Surfaces: Faces of doors and drawers when closed, and tops of cabinets less than 72 inches above furnished floor.
   5. Semi-Exposed Surfaces: Interior surfaces which are visible, bottoms of wall cabinets and tops of cabinets 72 inches or more above finished floor.
   6. Concealed Surfaces: Any surface not visible after installation.

1.05 QUALITY ASSURANCE

A. Manufacturer: Minimum of 5 years experience in providing manufactured casework systems for similar types of projects, produce evidence of financial stability, bonding capacity, and adequate facilities and personnel required to perform on this project.

B. Manufacturer: Provide products certified as meeting or exceeding ANSI-A 161.1 testing standards.

C. Sustainability and LEED Standards Certification:
   1. Regional manufactured products with percentage by weight.
   2. Recycled content calculated as 1/2 preconsumer + postconsumer.
   3. VOC content limitations defined in Section 018114, "Volatile Organic Compound (VOC) Limits For Adhesives, Sealants, Paints, and Coatings."
   4. No Added Urea Formaldehyde in product.

1.06 SUBMITTALS

A. Comply with Section 013000, unless otherwise indicated.

B. Product Data: Manufacturer's catalog with specifications and construction details.

C. Shop Drawings: Indicate dimensions, description of materials and finishes, general construction, specific modifications, component connections, anchorage methods, hardware, and installation procedures, plus the following specific requirements.
   1. Include section drawings of typical and special casework, work surfaces and accessories.
   2. Indicate locations of plumbing and electrical service field connection by others.

D. Casework Samples:
   1. Base cabinet: Cabinet conforming to specifications, with drawer and door.
   2. Wall cabinet: Cabinet conforming to specifications, with door.
   3. Cabinet samples shall be complete with specified hardware for doors, drawers and shelves.

E. Component samples: Two sets of samples for each of the following:
   1. Decorative laminate color charts.
   2. PVC edgings.

F. LEED Product and Material Data Summary Form: For all installed products and materials of this Section, complete the "LEED Product and Material Data Summary Form" (attached to end of Section 01 81 13 - Sustainable Design Requirements)
   1. Product Material Cost: Provide the cost for material, or an assembled product, including taxes and delivery but excluding any cost for labor and equipment required for installation after the material is delivered to the site.
   2. Product Data for Credit MRc4, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating cost for each product having recycled content.
   3. Product Data for Credit MRc5, Regional Material: For products having regional materials, documentation indicating location of raw material extraction, harvest or recovery, as well as, manufacture (location of final assembly) within 500 miles of project site. Include statement indicating cost for each material or component of the assembled product.
   4. Product Data for Credit EQc4.4, Composite Wood & Agrifiber Products: Product data sheets, MSDS, certificates or letter from product manufacture highlighting that the composite wood or agrifiber product and/or associated laminating adhesive do not contain urea-formaldehyde resin.

1.07 PRODUCT HANDLING

A. Deliver completed laminate clad casework, countertops, and related products only after wet operations in building are completed, store in ventilated place, protected from the weather, with relative humidity range of 25 percent to 55 percent.

B. Protect finished surfaces from soiling and damage during handling and installation with a protective covering.

1.08 JOB CONDITIONS

A. Environmental Requirements: Do not install casework until permanent HVAC systems are operating and temperature and humidity have been stabilized for at least 1 week.
   1. Manufacturer/Supplier shall advise Contractor of temperature and humidity requirements for architectural casework installation areas.
   2. After installation, control temperature and humidity to maintain relative humidity between 25 percent and 55 percent.

B. Conditions: Do not install casework until interior concrete work, masonry, plastering and other wet operations are complete.

1.09 WARRANTY

A. All materials and workmanship covered by this section will carry a five (5) year warranty from date of acceptance.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Approved Manufacturers:
   1. Basis of specification: TMI Systems Design Corporation.
   2. LSI
   3. Polyvision
   4. Case Systems

B. Substitutions: See Section 016000. Approved fabricators and manufacturers shall comply with the minimum levels of material and detailing indicated on the drawings or as specified.
   1. Fabricators meeting Quality Assurance requirements in PART 1 shall submit evidence of compliance with requirements for approval during bidding.

2.02 MATERIALS

A. Core Materials:
   1. Certified Particleboard: SCS Certified 100% pre-consumer recycled wood fiber particleboard with no Urea Formaldehyde added during the manufacturing process.
      a. Up to 7/8 inch thick: Industrial Grade average 47-pound density meeting ANSI A 208.1-1999, M-3 requirements.
      b. 1 inch think: Industrial Grade average 45-pound density meeting ANSI A 208.1-1999, M-2 requirements.
      c. MR Moisture Resistant Particleboard: Average 47-pound density particleboard, ANSI A208.1 1-1999, M-3.
   2. Medium Density Fiberboard 1/4 inch thick: Average 54-pound density grade, ANSI A208.2.

B. Decorative Laminates: GREENGAURD Indoor Air Quality Certified
   1. High-pressure decorative laminate VGS (.028), NEMA Test LD 3-2005.
   2. High-pressure decorative laminate HGS (.048), NEMA Test LD 3-2005.
   3. High-pressure decorative laminate HGP (.039), NEMA Test LD 3-2005.
   4. High-pressure cabinet liner CLS (.020), NEMA Test LD 3-2005.

5. High-pressure backer BKH (.048), (.039), (.028), NEMA Test LD3-2005.
6. Thermally fused melamine laminate, NEMA Test LD 3-2005, color matched with White.

C. Edging Materials:
1. Cabinet Body: 1mm PVC banding, machine applied.
2. Door and counter edges: 3mm PVC banding, machine applied and machine profiled to 1/8 inch radius.

2.03 SPECIALTY ITEMS

A. Support Members:
1. Countertop support brackets: Epoxy powder coated, 11 gauge steel with integral cleat mount opening and wire management opening.
2. Undercounter support frames: Epoxy powder coated.
3. Legs : Epoxy powder coated.

B. Miscellaneous:
1. Product: Round Grommet A2340 manufactured by TMI Systems.
2. Diameter: 3-5/8 inches

C. Teacher wardrobe:
1. See drawings for dimensions.
2. Provide hinged door with lock, one fixed shelf and rod, four adjustable shelves in 72" height; 5 adjustable shelves in 84" height; one 10" x12" mirror; pin tray; 16" coat hanging space. Provide with all closures and standard accessories shown or required.

2.04 CABINET HARDWARE

A. Hinges:
1. Five knuckle, epoxy powder coated, institutional grade, 2-3/4 inch overlay type with hospital tip. 0.095 inch thick. ANSI-BHMA standard A156.9, Grade 1.
   a. Doors 48 inches and over in height have 3 hinges per door.
   b. Magnetic door catch with maximum 5 pound pull provided, attached with screws and slotted for adjustment.

B. Pulls:
1. Door and drawer front pulls are rectangular, semi-recessed, injection molded plastic, screw fastened. Pull design shall comply with the Americans with Disability Act (ADA).

C. Drawer Slides:
1. Regular, knee space and pencil: 100-pound load rated epoxy coated steel, bottom corner mounted with smooth and quiet nylon rollers. Positive stop both directions with self-closing feature.
2. Paper storage: 150-pound load rated epoxy coated steel slides.
3. File: Full extension, 150-pound load rated epoxy coated steel, bottom corner mounted with smooth and quiet nylon rollers. Positive stop both directions with self-closing feature.

D. Adjustable Shelf Supports:
1. Injection molded transparent polycarbonate shelf supports friction fit into cabinet end panels and vertical dividers, adjustable. Shelf support have minimum 2 integral support pins to interface pre-drilled holes, and to prevent accidental rotation of support. The support shall adapt to 3/4 inch or 1 inch thick shelving and provides non-tip feature for shelving. Supports may be field fixed if desired. Structural load to 1200 pounds (300 pounds per support) without failure.

E. Locks:
   1. Removable core, disc tumbler, cam style lock with strike. Lock for sliding 3/4 inch thick doors is a disc type plunger lock, sliding door type with strike.
   2. Elbow catch or chain bolt used to secure inactive door on all locked cabinets.

F. Coat Rods: 1 inch diameter, 14-gauge chrome plated steel installed in captive mounting hardware.

G. File Suspension System: Extruded molding integral with top of drawer box sides to accept standard hanging file folders.

H. Mirrors: 1/4 inch thick polished mirror plate.

2.05 FABRICATION:

A. Fabricate casework, countertops and related products to dimensions, profiles, and details shown.

B. All casework panel components sized/cured to be precisely finished in size and squareness to within 0.010 inches, ensuring strict dimensional quality and structural integrity in the final fabricated product.

C. Cabinet Body Construction:
   1. Tops and bottoms shall be glued and doweled to cabinet sides and internal cabinet components such as fixed horizontals, rails and verticals.
      a. Tops, bottoms and sides of all cabinets are particleboard core.
      b. Tops, bottoms and sides of sink base units are moisture resistant particleboard core.
   2. Cabinet backs: 1/4 inch thick medium density fiberboard panel fully captured by the cabinet top, bottom and side panels. Finish to match cabinet interior. 3/4 inch x 4 inch particleboard rails will be placed behind the back panel at the top and bottom, and doweled to the sides utilizing 10mm hardwood fluted dowels. A third intermediate rail will be included on all cabinets taller than 56 inches. Utilize hot melt glue to further secure back and increase overall strength.
   3. Fixed base and tall cabinets shall have factory mounted bases of 3/4 inch thick exterior grade plywood. Base is nominal 4 inch high unless otherwise indicated on the drawings.
   4. Base units, except sink base units: Full sub-top. Sink base units are provided with open top and a stretcher at the front, attached to the sides. Back to be split removable access panel.
   5. Side panels and vertical dividers shall receive adjustable shelf hardware. Mount door hinges, drawer slides and pull-out shelves in the line boring for consistent alignment.
   6. Exposed and semi exposed edges.
      a. Edging: 1mm PVC.
   7. Adjustable shelf core: 3/4 inch thick particleboard up to 36 inches wide, 1 inch thick particleboard over 36 inches wide.
      a. Front edge: 1mm PVC.
   8. Interior finish, units with open Interiors:
      a. Top, bottom, back, sides, horizontal and vertical members, and adjustable shelving faces with VGS high-pressure decorative laminate.
   9. Interior finish, units with closed Interiors:
      a. Top, bottom, back, sides, horizontal and vertical members, and adjustable shelving faces with thermally fused melamine laminate.

10. Exposed ends:
    a. Faced with VGS high-pressure decorative laminate.
11. Wall unit bottom:
    a. Faced with thermally fused melamine laminate.
12. Balanced construction of all laminated panels is mandatory. Unfinished core stock surfaces, even on concealed surfaces (excluding edges), are not permitted.

D. Drawers:
1. Sides, back and sub front: Minimum 1/2 inch thick particleboard, laminated with thermally fused melamine doweled and glued into sides. Top edge banded with 3mm PVC.
2. Drawer bottom: Minimum 1/2 inch thick particleboard laminated with thermally fused melamine, screwed directly to the bottom edges of drawer box.
3. Paper storage drawers: Minimum 3/4 inch thick particleboard sides, back, and sub front laminated with thermally fused melamine. Minimum 1/2 inch thick particleboard drawer bottoms screwed directly to the bottom edges of the drawer box. Provide PVC angle retaining bar at the rear of the drawer.

E. Door/Drawer Fronts:
1. Core: 3/4 inch thick particleboard except at sink units which is 3/4 inch thick moisture resistant particleboard.
2. Provide double doors in opening in excess of 24 inches wide.
3. Faces:
    a. Exterior: VGS High-pressure decorative laminate.
    b. Interior: High-pressure cabinet liner CLS.
4. Door/drawer edges: 3mm PVC, external edges and outside corners machine profiled to 1/8 inch radius.

F. Miscellaneous Shelving:
1. Core material: 3/4 inch or 1 inch thick particleboard.
2. Exterior: VGS High-pressure decorative laminate.
3. Edges: 3mm PVC, external edges and outside corners machine profiled to 1/8 inch radius.

PART 3- EXECUTION

3.01 INSPECTION:

A. The casework contractor must examine the job site and the conditions under which the work under this section is to be performed, and notify the building owner in writing of unsatisfactory conditions. Do not proceed with work under this Section until satisfactory conditions have been corrected in a manner acceptable to the installer.

3.02 PREPARATION:

A. Condition casework to average prevailing humidity conditions in installation areas prior to installing.

3.03 KEYING:

A. Key alike by room, unless otherwise instructed.

B. Allow for 2 locked cabinets in each room, overhead and/or base (excluding teacher wardrobe)

3.04 INSTALLATION:

A. Erect casework, plumb, level, true and straight with no distortions. Shim as required. Where laminate clad casework abuts other finished work, scribe and cut for accurate fit.

B. Adjust casework and hardware so that doors and drawers operate smoothly without warp or bind.

C. Repair minor damage per plastic laminate manufacturer's recommendations.

3.05 CLEANING:

A. Remove and dispose of all packing materials and related construction debris.

B. Clean cabinets inside and out. Wipe off fingerprints, pencil marks, and surface soil etc., in preparation for final cleaning by the building owner.

3.06 COLOR SELECTION:

A. Laminate Color Selection: From Wilsonart, and Formica stock colors.

B. Hinge and Pull Color Selection: From manufacturer's standard

C. Miscellaneous Hardware Color Selection (support brackets, table frames, rail): From manufacturer's standard.

D. 1mm PVC Edge Banding Color Selection: From manufacturer's standard of colors matching decorative laminate.

E. 3mm PVC Edge Banding Color Selection: Match decorative laminate color selection.

END OF SECTION

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SECTION 12 36 00
COUNTERTOPS, BACKSPLASHES AND WINDOW STOOLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Countertops for manufactured casework.

B. Solid surface window stools.

C. Solid surface locker surround.

D. Solid surface wall cap.

E. Solid surface at display case.

F. Solid surface at bench seat.

1.02 RELATED REQUIREMENTS

A. Section 01 74 19 – Construction Waste Management.

B. Section 01 81 13 – Sustainable Design Requirements.

C. Section 01 81 19 – Indoor Air Quality Requirements.

1.03 REFERENCE STANDARDS

A. ANSI A208.1 - American National Standard for Particleboard; 2009.

B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.

C. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.0; 2016.

D. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.

E. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

F. PS 1 - Structural Plywood; 2009.

1.04 LEED REQUIREMENTS

A. LEED Focus Materials (LFMs) For This Section
   1. Targeted products containing Recycled Content (MRc4)
   2. Targeted products containing Regional Material (MRc5)

1.05 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Specimen warranty.

B. Shop Drawings: Complete details of materials and installation; combine with shop drawings of cabinets and casework specified in other sections.

C. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.

D. Verification Samples: For each finish product specified, minimum size 6 inches square, representing actual product, color, and patterns.

E. Test Reports: Chemical resistance testing, showing compliance with specified requirements.

F. Installation Instructions: Manufacturer's installation instructions and recommendations.

G. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

H. LEED Product and Material Data Summary Form: For all installed products and materials of this Section, complete the "LEED Product and Material Data Summary Form" (attached to end of Section 01 81 13 - Sustainable Design Requirements)
   1. Product Material Cost: Provide the cost for material, or an assembled product, including taxes and delivery but excluding any cost for labor and equipment required for installation after the material is delivered to the site.
   2. Product Data for Credit MRc4, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating cost for each product having recycled content.
   3. Product Data for Credit MRc5, Regional Material: For products having regional materials, documentation indicating location of raw material extraction, harvest or recovery, as well as, manufacture (location of final assembly) within 500 miles of project site. Include statement indicating cost for each material or component of the assembled product.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.

B. Sustainability and LEED Standards Certification:
   1. Regional manufactured products with percentage by weight.
   2. Recycled content calculated as 1/2 preconsumer + postconsumer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.08 FIELD CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.01 COUNTERTOPS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Solid Surfacing Countertops, window stools, wall caps, locker surrounds, interior bench seat, and display cases: Solid surfacing sheet or plastic resin casting over continuous substrate.
   1. Flat Sheet Thickness: 1/2 inch, minimum.
   2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
      a. Basis of Design: Dupont; Corian: www.corian.com

b. Acceptable Manufacturers:
   1) Avonite Surfaces: www.avonitesurfaces.com.
   2) Formica Corporation: www.formica.com.
   3) Substitutions: See Section 01 60 00 - Product Requirements.
c. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
d. Color and Pattern: As indicated on drawings.

3. Other Components Thickness: 1/2 inch, minimum.
4. Exposed Edge Treatment: Built up to minimum 1-1/4 inch thick; eased edge top and bottom.
5. Back and End Splashes: Same sheet material, square top; minimum 4 inches high.

2.02 MATERIALS

A. Wood-Based Components:
   1. Wood fabricated from old growth timber is not permitted.
   2. Provide sustainably harvested wood, certified or labeled as specified in Section 01 60 00 - Product Requirements.

B. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch thick; join lengths using metal splines.

C. Particleboard for Supporting Substrate: ANSI A208.1 Grade 2-M-2, 45 pcf minimum density; minimum 3/4 inch thick; join lengths using metal splines.

D. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.

E. Joint Sealant: Mildew-resistant silicone sealant, clear.

2.03 FABRICATION

A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
   1. Join lengths of tops using best method recommended by manufacturer.
   2. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall.
   3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.

B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
   1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
   2. Height: 4 inches, unless otherwise indicated.

C. Solid Surfacing: Fabricate tops up to 144 inches long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.

PART 3 EXECUTION

3.01 INSTALLATION

A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.

B. Seal joint between back/end splashes and vertical surfaces.

3.02 CLEANING

A. Clean countertops surfaces thoroughly.

3.03 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 12 61 00
FIXED AUDIENCE SEATING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fixed, upholstered theater chairs.

B. Support standards.

C. Chair accessories.

1.02 RELATED REQUIREMENTS

A. Section 01 74 19 – Construction Waste Management.

B. Section 01 81 13 – Sustainable Design Requirements.

C. Section 01 81 19 – Indoor Air Quality Requirements.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

C. ASTM A879/A879M - Standard Specification for Steel Sheet, Zinc Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface; 2012 (Reapproved 2017).

D. ASTM D3597 - Standard Specification for Woven Upholstery Fabrics--Plain, Tufted, or Flocked; 2002 (Reapproved 2013).

E. ASTM E1352 - Standard Test Method for Cigarette Ignition Resistance of Mock-Up Upholstered Furniture Assemblies; 2016.

F. ASTM E1537 - Standard Test Method for Fire Testing of Upholstered Furniture; 2016.

G. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; 2016.

H. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

1.04 LEED REQUIREMENTS

A. LEED Focus Materials (LFMs) For This Section
   1. Targeted products containing Recycled Content (MRc4)
   2. Targeted products containing Regional Material (MRc5)

1.05 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Product Data: Manufacturer's printed data sheets for products specified.

C. Shop Drawings: Fabrication and installation details, chair layouts and dimensions and seat numbering scheme.
   1. Field Measurements: Verify seating layout by field measurements and record field dimensions on shop drawings.

D. Selection Samples: Manufacturer's color charts and swatches for fabric upholstery, indicating full range of materials, colors, and patterns available.

E. Maintenance Materials:
   1. See Section 01 60 00 - Product Requirements, for additional provisions.

F. LEED Product and Material Data Summary Form: For all installed products and materials of this Section, complete the "LEED Product and Material Data Summary Form" (attached to end of Section 01 81 13 - Sustainable Design Requirements)
   1. Product Material Cost: Provide the cost for material, or an assembled product, including taxes and delivery but excluding any cost for labor and equipment required for installation after the material is delivered to the site.
   2. Product Data for Credit MRc4, Recycled Content: For products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating cost for each product having recycled content.
   3. Product Data for Credit MRc5, Regional Material: For products having regional materials, documentation indicating location of raw material extraction, harvest or recovery, as well as, manufacture (location of final assembly) within 500 miles of project site. Include statement indicating cost for each material or component of the assembled product.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer certified in writing by the seating manufacturer to be qualified for installation of specified seating.

B. Fire Retardance of Upholstered Seating: Self-extinguishing when mock-up is exposed to smoldering cigarettes in accordance with ASTM E1352 or NFPA 261.

C. Fire Retardance of Fixed Theater Seating: Maximum instantaneous net peak rate of heat release of 250 kW or less, and total energy released during first 5 minutes of 40 mJ or less, when tested in accordance with ASTM E1537.

D. Sustainability and LEED Standards Certification:
   1. Regional manufactured products with percentage by weight.
   2. Recycled content calculated as 1/2 preconsumer + postconsumer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver seats to project site in unopened containers clearly labeled with manufacturer's name and identification of contents.

B. Store seating units in dry and clean location until needed for installation. During installation, handle in a manner that will prevent marring and soiling of finished surfaces.

1.08 PROJECT CONDITIONS

A. Field Measurements:
   1. Take field measurements to verify or supplement dimensions indicated on contract drawings prior to manufacturing.

1.09 WARRANTY

A. Provide a manufacturer's warranty covering the material and workmanship for the specified warranty period from date of final acceptance.

B. Warranty Periods:
   1. Structural Components: five years.
   2. Operating Mechanisms: five years.
   3. Plastic, Wood and Painted Components: five years.

4. Upholstery Fabric: one year.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fixed Theater Seating
   1. Irwin Seating Company; www.irwinseating.com
      a. Product: 90.12.86.12 Citation
      b. Aisle Panel Laminate: W8371T Grand Island Maple
      c. Armrest: No. 17 India Teak on Maple
      d. Plastic/Powdercoat: Cadet Grey (CDT)
   2. Theatre Solutions, Inc: www.theatresolutions.net

B. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 MATERIALS

A. Sheet Steel: ASTM A879/A879M, Commercial Steel (CS) or Drawing Steel (DS) electrogalvanized sheet, 04Z (12G) coating class on both surfaces; chemically treated for baked enamel finish.

B. Steel Plates, Bars, and Tubes: ASTM A36/A36M.

C. Hardwood Plywood: HPVA HP-1; face veneers for exposed surfaces Grade A hardwood veneer core, with no visible defects; concealed surface veneers of sound grade hardwood.

D. Laminated Plastic: NEMA LD 3, Type 1, Grade GP 50, nominal thickness 0.050 in; colors and patterns as selected from manufacturer's standards.

E. Polypropylene Sheet: Molded high density plastic with minimum tensile strength of 3300 psi, integral color pigments, and textured, scuff-resistant surface finish.

F. Polyurethane Foam: Density not less than 1.8 lb/cu ft, fire retardant, non-hardening and non-oxidizing, with high resistance to alkalis, oils, moisture, and mildew.

G. Molded Plastics:
   1. Structural components shall be mar and dent resistant high density glass-filled polypropylene with UV stabilizers
   2. Decorative components shall be mar and dent resistant high density polyethylene (HDPE) with UV stabilizers.
   3. Plastic components shall be chosen from manufacturer's standard offering.

H. Upholstery Fabric: ASTM D3597 heavy-duty plain woven nylon fabric, treated to resist cigarette ignition and staining; color and pattern as selected from manufacturer's standards.

2.03 UPHOLSTERED CHAIRS

A. Backs: Fixed type; two-panel construction with fabric covering over padding and protective back panel, with installed height not less than 32 inches above finished floor.
   1. Padding: Polyurethane foam not less than 1 in thick bonded to structural support.
   2. Covering: Fabric bonded to padding and fastened by upholstery technique that facilitates replacement.
   3. Rear Panel: One-piece injection molded high-impact plastic, with scuff-resistant textured surface.

B. Seats: Hinged type, constructed to permit reupholstering without removing seat from chair.

1. Steel Seat Construction: One-piece sheet steel pan construction, reinforced at stress points; supporting not fewer than 16 coil springs or five non-sag serpentine springs. Separate padding from springs with burlap sheeting cemented to polyurethane foam padding formed with minimum thickness of 1-3/4 in. Upholster with fabric sewn into box construction without welts and securely fastened to supporting frame to provide smooth, wrinkle-free surface.
    a. For serpentine spring construction, provide not less than 3 in thick foam padding at front edge of seat.

C. Hinges: Self-lubricating, noiseless steel hinges with brass alloy bearings or nylon bushings, equipped with spring mechanism that causes unoccupied seat to rise automatically to uniform 3/4 fold, with 100 percent fold when additional pressure is applied.

D. Arm Rests: Locate at aisles and between chairs; mount to support standard with concealed fasteners; exposed surfaces of solid hardwood lumber with smoothed edges.

E. End Panels: One piece panels fastened securely to aisle standards with concealed fasteners, configured as follows:
1. Shape: Rectangular with curved bottom edge.
2. Finish: Plastic laminate.

2.04 STANDARDS

A. Support Standards: Sheet steel with formed edges and with welded mounting points for backs, seats, and arm rests, and welded floor anchor plates.

2.05 ACCESSORIES

2.06 FINISHES

A. Ferrous Metals: Manufacturer's standard two-coat baked enamel finish, applied over conversion coating appropriate to base metal.

B. Hardwood Plywood: Manufacturer's standard clear low-gloss finish.

PART 3 EXECUTION

3.01 INSTALLATION

A. Comply with manufacturer's installation instructions and approved shop drawings.

B. Anchor support standards securely to substrate with at least two anchoring devices recommended by manufacturer.

3.02 ADJUSTING

A. Adjust seat mechanisms to ensure that seats in each row are aligned when unoccupied.

B. Repair minor abrasions and imperfections in painted finishes with a coating that matches factory-applied finish; replace units that cannot be repaired to unblemished appearance.

C. Replace upholstery fabric damaged or soiled during installation.

END OF SECTION

SECTION 12 66 13
TELESCOPING BLEACHERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Telescoping bleachers.

1.02 REFERENCE STANDARDS

A. NFPA 102 - Standard for Grandstands, Folding and Telescopic Seating, Tents, and Membrane Structures; 2016.

B. PS 1 - Structural Plywood; 2009.

C. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015 (with March 2016 Errata).

D. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; 2008.

1.03 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage handling and requirements.
   3. Installation methods.

C. Shop Drawings: Complete layout with dimensions, seat heights, row spacing and rise, aisle widths and locations, points of connection to substrate, assembly dimensions, and material types and finishes.
   1. Provide drawings customized to this project.
   2. Include Professional Engineer certification.

D. Selection Samples: For each material for which color selection is required, submit samples, 2 by 2 inches in size, illustrating colors and finishes available.

E. Operation and Maintenance Data: Manufacturer's operation and maintenance instructions, including annual inspection and maintenance and bi-annual inspection by a Professional Engineer or manufacturer factory service personnel.

F. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

B. Installer Qualifications: Manufacturer's installation crew.

C. Welder Qualifications: Certified by AWS for the process employed.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store, in original packaging, under cover and elevated above grade.

1.06 WARRANTY

A. See Section 01 77 00 - Closeout Procedures, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion. Replace parts that fail under normal use at no extra charge to Owner.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Telescoping Bleachers:
   1. Interkal LLC: www.interkal.com.
   2. Irwin Telescopic Seating Company: www.irwintelescopicseating.com.
   3. Hussey Seating Company: www.husseyseating.com.

B. NOTE: Existing gymnasium bleachers are manufactured by Hussey Seating Co., New bleachers should match style, finish, and configuration of existing.

2.02 TELESCOPING BLEACHERS

A. Telescoping Bleachers: Factory assembled tiered benches that retract horizontally into depth approximately the same as a single row depth, with fixed seats mounted on leading edge of platforms.
   1. Design to comply with applicable requirements of NFPA 102 and requirements of code authorities having jurisdiction; where conflicts between requirements occur, comply with whichever is more stringent.
   2. Design with solid fascia (riser) or seat fronts that conceal interior mechanisms when fully retracted, fitting tightly enough to prevent climbing up face; at front row provide key locked, hinged fascia (skirt) to cover gap between seat riser/fascia and floor.
   3. Operation: Manual.

B. Design Loads: Design to withstand the following loading conditions:
   1. Live Load on Structural Supports: 100 psf, minimum, of gross horizontal projection.
   2. Live Load on Seats and Walking Surfaces: 120 pounds per linear foot.
   3. Lateral Sway Stress on Structural Supports: 24 pounds per linear foot of seat plank.
   4. Perpendicular Sway Stress on Structural Supports: 10 pounds per linear foot of seat plank.

C. Dimensions:
   1. See Contract Drawings for overall dimensions.
   2. Rows: 4.
   3. Seat Height Above Tread: 6 inches.

D. Structural Supports: Steel or aluminum; manufacturer's standard wheeled carriages supporting each tier separately, with moving parts permanently lubricated and metal parts cushioned to prevent metal-to-metal contact during operation.
   1. Design so that each row carriage so that it will individually support the design loads and is self supporting when fully assembled without dependence on platform panels or boards, seats, or fascia.
   2. Welding: In accordance with AWS D1.1/D1.1M and AWS D1.3/D1.3M.
   3. Bolting: Use lock-washers or locknuts.
   4. Wheels: Minimum 5 inch diameter by 1-1/8 inch wide, with non-marring rubber tires; ball, roller, or oil-impregnated metal bearings; minimum of 2 wheels at each floor support.
   5. Finish: Manufacturer's standard enamel or powder coating.
   6. Row Locking: Automatically mechanically lock each carriage to adjacent carriages when fully extended.

7. Unlocking: Provide single manual release mechanism to allow retraction of all carriages, concealed behind skirt board of first row.

2.03 SEAT AND PLATFORM COMPONENTS

A. Seat/Fascia Assembly: Continuous, molded UV-stabilized high-density polyethylene plastic, seat minimum 1 inch thick, textured finish, homogeneous color throughout, color as selected from manufacturer's standard selection; approximately 18 inch long sections independently removable with tongue-and-groove or rabbeted interlock at end joints.
   1. Shape: Ergonomically contoured, with internal ribs spaced for natural flexibility; rear edge cantilevered to provide toe room of not less than 3 inches; no openings to trap debris.
   2. Provide end caps of same material and finish on each exposed end.
   3. Supports: Internal steel reinforcement of each seat segment bolted to platform nose member; minimum two bolts per segment.

B. Platform, Tread, and Step Structure: Plywood continuously supported on front and rear with side joints tongue-and-grooved.
   1. Plywood: PS 1, 5-ply southern pine or polyethylene-overlaid douglas fir or southern pine, Grade A-C.
   2. Plywood Thickness: 5/8 inch, minimum.
   3. Front (Nose), Rear, and Intermediate Supports: Steel channel or tube, hot-dipped galvanized.
   4. Provide end caps of same material and finish on each exposed end.
   5. Finish: High gloss clear urethane, both sides, unless polyethylene finished.

2.04 HANDRAILS AND RAILINGS

A. Provide the following railings:
   1. Aisle Handrails: Removable one- or two-post railing segment mounted in center of aisle at every other row beginning at row 2.
   2. End of Row Guardrails: Self-storing, at open ends of sections beginning at row 2.
   3. Height: 42 inches above adjacent platform or tread.
   4. Removable Railings: Provide steel post sockets attached to platform supports.

B. Design handrails and railings to withstand the following loads:
   1. Concentrated Load on Handrails: 200 pounds in any direction.
   2. Concentrated Load on Guardrails: 200 pounds in any direction along top rail.
   3. Live Load on Handrails: 50 pounds per linear foot, applied in any direction.
   4. Live Load on Guardrails:
      a. Horizontal: 50 pounds per linear foot, applied at the guardrail height.
      b. Vertical: 100 pounds per linear foot, applied vertically to top of guardrail.

C. Railing Construction: Round steel or aluminum pipe or tube, with formed elbows at corners and caps at ends of straight runs.
   1. Aluminum: 1.66 inches minimum outside diameter; natural anodized finish.
   2. Steel: 1-1/2 inch minimum outside diameter, with 11 gage, 0.12 inch minimum wall thickness; textured powder coat epoxy finish.

2.05 ACCESSORIES

A. Fillers and Closures:

1. Ends of Retracted Units: Plywood panels, finished to match platforms.

B. Fasteners: Provide hardware and fasteners in accordance with manufacturer's recommendations.

C. Anchorage: As indicated on drawings; provide hardware in accordance with manufacturer's recommendations.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are consistent with those on the shop drawings.

B. Do not begin installation until substrates have been properly prepared and area has been cleared of obstructions.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Do not field cut or alter seats, fascia, or structural members without approval.

C. Provide manufacturer's field representative to inspect completed installation.

3.04 ADJUSTING

A. Lubricate, test, and adjust each moving assembly to ensure proper operation in compliance with manufacturer's recommendations.

3.05 CLEANING

A. Clean exposed and semi-exposed assembly surfaces.

B. Touch up finishes on damaged or soiled areas.

3.06 CLOSEOUT ACTIVITIES

A. Demonstration and Training: Provide manufacturer's field representative to demonstrate to and train Owner's operating personnel in proper operation of equipment.
   1. Location: On site using installed equipment.
   2. Time: As agreed between Owner and Contractor.

3.07 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair, or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 14 21 00
ELECTRIC TRACTION ELEVATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Complete electric traction elevator systems.
   1. Passenger type.

B. Elevator Maintenance Contract.

1.02 RELATED REQUIREMENTS

A. Section 04 20 00 - Unit Masonry: Masonry hoistway enclosure; building-in and grouting hoistway door frames.

B. Section 05 50 00 - Metal Fabrications: Includes elevator pit ladder, sill supports, and overhead hoist beams.

C. Section 09 65 00 - Resilient Flooring: Floor finish in car.

D. Section 21 13 00 - Fire-Suppression Sprinkler Systems: Sprinkler heads in hoistway.

E. Section 26 05 83 - Wiring Connections:
   1. Providing electrical service to elevators, including fused disconnect switches where permitted.
   2. Emergency power supply, transfer switch and auxiliary contacts.
   3. Heat and smoke sensing devices
   4. Electrical service for convenience outlets and elevator pit.
   5. Lighting in elevator pit.

1.03 REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. ASME A17.1 - Safety Code for Elevators and Escalators; 2013.

C. ASME A17.2 - Guide for Inspection of Elevators, Escalators, and Moving Walks; 2014.

D. ASME QEI-1 - Standard for the Qualification of Elevator Inspectors; 2013.

E. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015 (with March 2016 Errata).

F. NFPA 13 - Standard for the Installation of Sprinkler Systems; 2016.

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.

I. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.04 SUBMITTALS

A. See Section 01 31 00 - Project Management and Coordination, for submittal procedures.

B. Product Data: Submit data on following items:
   1. Signal and operating fixtures, operating panels, and indicators.
   2. Car design, dimensions, layout, and components.
   3. Car and hoistway door and frame details.

4. Electrical characteristics and connection requirements.

C. Shop Drawings: Submit drawings and details on following items:
1. Elevator Equipment and Machines: Size and location of driving machines, power units, controllers, governors, and other components.
2. Hoistway Components: Size and location of car machine beams, guide rails, buffers, ropes, and other components.
3. Rail bracket spacing; maximum loads imposed on guide rails requiring load transfer to building structural framing.
4. Location and sizes of hoistway and car doors and frames.
5. Electrical characteristics and connection requirements.
6. Indicate arrangement of elevator equipment and allow for clear passage of equipment through access openings.
7. Show floors served, travel distances, maximum loads imposed on the building structure at points of support and all similar considerations of the elevator work.

D. Samples: Submit samples illustrating car interior finishes and car and hoistway door and frame finishes in the form of finish color selection brochures.

E. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

F. Initial Maintenance Contract.

G. Maintenance Contract: Submit proposal to Owner for standard one year continuing maintenance contract agreement in accordance with ASME A17.1 and requirements as indicated, starting on date initial maintenance contract is scheduled to expire.
1. Indicate in proposal the services, obligations, conditions, and terms for agreement period and for renewal options.

H. Operation and Maintenance Data:
1. Parts catalog with complete list of equipment replacement parts; identify each entry with equipment description and identifying code.
2. Operation and maintenance manual.
3. Schematic drawings of equipment, and wiring diagrams of installed electrical equipment with list of corresponding symbols to identify markings on hoistway apparatus.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: Perform design under direct supervision of a licensed Professional Structural Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum ten years documented experience.

C. Installer Qualifications: Supervisor along with trained elevator installation personnel on staff of elevator equipment manufacturer.

D. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

E. Products Requiring Fire Resistance Rating: Listed and classified by ITS (DIR), UL (DIR), or testing agency acceptable to authorities having jurisdiction.

1.06 WARRANTY

A. See Section 01 77 00 - Closeout Procedures, for additional warranty requirements.

B. Provide manufacturer's warranty for elevator operating equipment and devices for one year from Date of Substantial Completion.

1.07 MAINTENANCE TOOLS AND DIAGNOSTIC EQUIPMENT

A. A. It is the intent of this specification to allow for the Owner's non-proprietary maintenance of elevators and equipment.

B. Where specialized diagnostic tools or equipment are required in order to maintain elevator and elevator equipment, provide these tools and equipment to the Owner at project closeout.

C. Include diagnostic software, access codes, passwords and other proprietary information as necessary in order to interface with elevator equipment.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design - Electric Traction Elevators: ThyssenKrupp Elevator; enduraMRL 3500; www.thyssenkruppelevator.com

B. Other Acceptable Manufacturers - Electric Traction Elevators:
   1. Otis Elevator Company: www.otis.com.
   2. Schindler Elevator Corporation; Schindler 3300 Low-Rise MRL: www.us.schindler.com.

C. Substitutions: See Section 01 60 00 - Product Requirements.
   1. For any product not identified as Basis of Design, submit information as specified for substitutions.

D. Products other than Basis of Design are subject to compliance with specified requirements and prior approval of Architect. By using products other than Basis of Design, the Contractor accepts responsibility for costs associated with any necessary modifications to related work, including any design fees.

E. Source Limitations: Provide elevator and associated equipment and components produced by the same manufacturer as the other elevator equipment used for this project and obtained from a single supplier.

2.02 ELECTRIC TRACTION ELEVATORS

A. Elevator No.2
   1. Elevator Model: enduraMRL Above-Ground (1-stage)
   2. Elevator Type: Hydraulic Machine Room-Less, Passenger
   3. Rated Capacity: 3500 lbs.
   4. Rated Speed: 110 ft./min.
   5. Operation System: TAC32H
   6. Travel: 12 feet 0 inches (verify in field)
   7. Landings: 2 total
   8. Openings:
      a. Front: 1
      b. Rear: 0
   9. Clear Car Inside: 6' - 8" wide x 5' - 5" deep
   10. Cab Height: 8'-0" standard
   11. Hoistway Entrance Size: 3' - 6" wide x 7'-0" high
   12. Door Type: Single Speed

13. Power Characteristics: 460 volts, 3 Phase, 60 Hz.
14. Seismic Requirements: Zone 1
15. Hoistway Dimensions: 8' - 4" wide x 6' - 11" deep
16. Pit Depth: 4' - 0"
17. Button & Fixture Style: Signa4 Signal

2.03 HOISTWAY EQUIPMENT

A. Platform: Fabricated frame of formed or structural steel shapes, gusseted and rigidly welded with a wood sub-floor. Underside of the platform shall be fireproofed. The car platform shall be designed and fabricated to support one-piece loads weighing up to 25% of the rated capacity.

B. Sling: Steel stiles bolted or welded to a steel crosshead and bolstered with bracing members to remove strain from the car enclosure.

C. Guide Rails: Steel, omega shaped, fastened to the building structure with steel brackets.

D. Guides: Slide guides shall be mounted on top and bottom of the car.

E. Buffers: Provide substantial buffers in the elevator pit. Mount buffers on continuous channels fastened to the elevator guide rail or securely anchored to the pit floor. Provide extensions if required by project conditions.

F. Jack: A jack unit shall be of sufficient size to lift the gross load the height specified. Factory test jack to insure adequate strength and freedom from leakage. Brittle material, such as gray cast iron, is prohibited in the jack construction. Provide the following jack type: Twin post holeless. Two jacks piped together, mounted one on each side of the car with a polished steel hydraulic plunger housed in a sealed steel casing having sufficient clearance space to allow for alignment during installation. Each plunger shall have a high pressure sealing system which will not allow for seal movement or displacement during the course of operation. Each Jack Assembly shall have a check valve built into the assembly to allow for automatically re-syncing the two plunger sections by moving the jack to its fully contracted position. The jack shall be designed to be mounted on the pit floor or in a recess in the pit floor. Each jack section shall have a bleeder valve to discharge any air trapped in the section..

G. Automatic Self-Leveling: Provide each elevator car with a self-leveling feature to automatically bring the car to the floor landings and correct for over travel or under travel. Self-leveling shall, within its zone, be automatic and independent of the operating device. The car shall be maintained approximately level with the landing irrespective of its load.

H. Wiring, Piping, and Oil: Provide all necessary hoistway wiring in accordance with the National Electrical Code. All necessary code compliant pipe and fittings shall be provided to connect the power unit to the jack unit. theoiltype

I. Pit moisture/water sensor located approximately 1 foot above the pit floor to be provided. Once activated, elevator will perform “flooded pit operation”, which will run the car up to the designated floor, cycle the doors and shut down and trip the circuit breaker shunt to remove 3 phase power from all equipment, including pit equipment.

J. Motorized oil line shut-off valve shall be provided that can be remotely operated from the controller landing service panel. Also a means for manual operation at the valve in the pit is required.

2.04 POWER UNIT

A. Power Unit (Oil Pumping and Control Mechanism): A self-contained unit located in the elevator pit consisting of the following items:
   1. NEMA 4/Sealed Oil reservoir with tank cover including vapor removing tank breather
   2. An oil hydraulic pump.
   3. An electric motor.
   4. Electronic oil control valve with the following components built into single housing; high pressure relief valve, check valve, automatic unloading up start valve, lowering and leveling valve, and electro-magnetic controlling solenoids.

B. Pump: Positive displacement type pump specifically manufactured for oil-hydraulic elevator service. Pump shall be designed for steady discharge with minimum pulsation to give smooth and quiet operation. Output of pump shall not vary more than 10 percent between no load and full load on the elevator car.

C. Motor: Standard manufacture motor specifically designed for oil-hydraulic elevator service. Duty rating - motors shall be capable of 80 starts per hour with a 30% motor run time during each start.

D. Oil Control Unit: The following components shall be built into a single housing. Welded manifolds with separate valves to accomplish each function are not acceptable. Adjustments shall be accessible and be made without removing the assembly from the oil line.
   1. Relief valve shall be adjustable and be capable of bypassing the total oil flow without increasing back pressure more than 10 percent above that required to barely open the valve.
   2. Up start and stop valve shall be adjustable and designed to bypass oil flow during start and stop of motor pump assembly. Valve shall close slowly, gradually diverting oil to or from the jack unit, ensuring smooth up starts and up stops.
   3. Check valve shall be designed to close quietly without permitting any perceptible reverse flow.
   4. Lowering valve and leveling valve shall be adjustable for down start speed, lowering speed, leveling speed and stopping speed to ensure smooth "down" starts and stops. The leveling valve shall be designed to level the car to the floor in the direction the car is traveling after slowdown is initiated.
   5. Provided with constant speed regulation in both up and down direction. Feature to compensate for load changes, oil temperature, and viscosity changes.
   6. Solid State Starting: Provide an electronic starter featuring adjustable starting currents.
   7. A secondary hydraulic power source (powered by 110VAC single phase) must be provided. This is required to be able to raise (reposition) the elevator in the event of a system component failure (i.e. pump motor, starter, etc.)
   8. Oil Type: Provide a zinc free, inherently biodegradable lubricant formulated with premium base stocks to provide outstanding protection for demanding hydraulic systems, especially those operating in environmentally sensitive areas.

2.05

2.06 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with ASME A17.1, applicable local codes, and authorities having jurisdiction (AHJ).

B. Accessibility Requirements: Comply with ADA Standards.

C. Perform structural steel design, fabrication, and installation in accordance with AISC 360.

D. Perform welding of steel in accordance with AWS D1.1/D1.1M.

E. Fabricate and install door and frame assemblies in accordance with NFPA 80 and in compliance with requirements of authorities having jurisdiction.

F. Perform electrical work in accordance with NFPA 70.

G. Comply with fire protection sprinkler system of the hoistway design in accordance with NFPA 13 requirements and authorities having jurisdiction. Refer to Section 21 13 00.

2.07 EMERGENCY POWER

A. Elevator Emergency Power Supply: Supplied by battery backup; provide elevator system components as required for emergency power characteristics.

B. Emergency Lighting: Comply with ASME A17.1 elevator lighting requirements.

C. Provide operational control circuitry for adapting the change from normal to emergency power.

D. Upon transfer to emergency power, advance one elevator at a time to a pre-selected landing, stop car, open doors, disable operating circuits, and hold in standby condition.

2.08 MATERIALS

A. Rolled Steel Sections, Shapes, Rods: ASTM A36/A36M.

B. Steel Sheet: ASTM A1008/A1008M, Designation CS (commercial steel), with matte finish.

C. Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.

D. Stainless Steel Sheet: ASTM A666, Type 304; No. 4 Brushed finish unless otherwise indicated.

E. Stainless Steel Bars, Shapes and Moldings: ASTM A276/A276M, Type 304.

F. Extruded Aluminum: ASTM B221 (ASTM B221M), natural anodized finish unless otherwise indicated.

G. Plywood: PS 1, Structural I, Grade C-D or better, sanded.

H. Resilient Flooring: Vinyl tile flooring and Resilient flooring, as specified in Section 09 65 00.

I. Plastic Laminate: NEMA LD 3, GP-50, color as selected by Architect from manufacturer's standard line of colors.

2.09 CAR AND HOISTWAY ENTRANCES

A. Elevator, No. 2:

1. Car and Hoistway Entrances:

a. Hoistway Fire Rating: 2 Hours.

b. Elevator Door Fire Rating: 1-1/2 Hours.

c. Framed Opening Finish and Material: Brushed stainless steel.

d. Car Door Material: Stainless steel, with rigid sandwich panel construction.

e. Hoistway Door Material: Stainless steel, with rigid sandwich panel construction.

f. Door Type: Double leaf.

g. Door Operation: Side opening, two speed.

h. Door Width: 42 inch.

i. Door Height: 84 inch.

j. Sills: Extruded aluminum.

B. Integrated Control System: the elevator controller to be mounted to hoistway entrance above 1st landing. The entrance at this level, shall be designed to accommodate the control system and provide a means of access to critical electrical components and troubleshooting features. See section 2.09 Control System for additional requirements.

C. At the controller landing, the hoistway entrance frame shall have space to accommodate and provide a lockable means of access (group 2 security) to a 3 phase circuit breaker. See section 2.11 Miscellaneous Elevator Components for further details

D. Interlocks: Equip each hoistway entrance with an approved type interlock tested as required by code. Provide door restriction devices as required by code.

E. Door Hanger and Tracks: Provide sheave type two point suspension hangers and tracks for each hoistway horizontal sliding door.
   1. Sheaves: Polyurethane tires with ball bearings properly sealed to retain grease.
   2. Hangers: Provide an adjustable device beneath the track to limit the up-thrust of the doors during operation.
   3. Tracks: Drawn steel shapes, smooth surface and shaped to conform to the hanger sheaves.

F. Hoistway Sills: Extruded metal, with groove(s) in top surface. Provide mill finish on aluminum.

G. Gasketing: Provide acoustic type gasketing at hoistway doors and frames to eliminate audible noise due to car activities in the hoistway, and air pressure differential between hoistway and landing floors.

2.10 PASSENGER ELEVATOR CAR ENCLOSURE

A. Car Enclosure:
   1. Walls: Cab type a laminate wall design, durable wood core finished on both sides with high pressure plastic laminate.
   2. Reveals and frieze: Not applicable
   3. Canopy: Cold-rolled steel with hinged exit.
   4. Ceiling: Suspended type, LED lighting with translucent diffuser mounted in a metal frame. Framework shall be finished with a factory applied powder coat finish.
   5. Cab Fronts, Return, Transom, Soffit and Strike: Provide panels faced with No. 4 brushed stainless steel
   6. Doors: Horizontal sliding car doors reinforced with steel for panel rigidity. Hang doors on sheave type hangers with polyurethane tires that roll on a polished steel track and are guided at the bottom by non-metallic sliding guides.
      a. Door Finish: Stainless steel panels: No. 4 brushed finish.
      b. Cab Sills: Extruded aluminum, mill finish.
   7. Handrail: Provide 4" flat metal bar on side and rear walls on front opening cars and side walls only on front and rear opening cars. Handrails shall have a stainless steel, No. 4 brushed finish.
   8. Ventilation: Manufacturer’s standard exhaust fan, mounted on the car top.
   9. Protection pads and buttons: Not required

B. Car Top Inspection: Provide a car top inspection station with an “Auto-Inspection” switch, an "emergency stop" switch, and constant pressure "up and down" direction and safety buttons to make the normal operating devices inoperative. The station shall give the inspector complete

control of the elevator. The car top inspection station shall be mounted in the door operator assembly.

2.11 DOOR OPERATION

A. Door Operation: Provide a direct or alternating current motor driven heavy duty operator designed to operate the car and hoistway doors simultaneously. The door control system shall be digital closed loop and the closed loop circuit shall give constant feedback on the position and velocity of the elevator door. The motor torque shall be constantly adjusted to maintain the correct door speed based on its position and load. All adjustments and setup shall be through the computer based service tool. Door movements shall follow a field programmable speed pattern with smooth acceleration and deceleration at the ends of travel. The mechanical door operating mechanism shall be arranged for manual operation in event of power failure. Doors shall automatically open when the car arrives at the landing and automatically close after an adjustable time interval or when the car is dispatched to another landing. AC controlled units with oil checks, or other deviations are not acceptable.
   1. No Un-Necessary Door Operation: The car door shall open only if the car is stopping for a car or hall call, answering a car or hall call at the present position or selected as a dispatch car.
   2. Door Open Time Saver: If a car is stopping in response to a car call assignment only (no coincident hall call), the current door hold open time is changed to a shorter field programmable time when the electronic door protection device is activated.
   3. Double Door Operation: When a car stops at a landing with concurrent up and down hall calls, no car calls, and no other hall call assignments, the car door opens to answer the hall call in the direction of the car's current travel. If an onward car call is not registered before the door closes to within 6 inches of fully closed, the travel shall reverse and the door shall reopen to answer the other call.
   4. Nudging Operation: The doors shall remain open as long as the electronic detector senses the presence of a passenger or object in the door opening. If door closing is prevented for a field programmable time, a buzzer shall sound. When the obstruction is removed, the door shall begin to close at reduced speed. If the infra-red door protection system detects a person or object while closing on nudging, the doors shall stop and resume closing only after the obstruction has been removed.
   5. Door Reversal: If the doors are closing and the infra-red beam(s) is interrupted, the doors shall reverse and reopen. After the obstruction is cleared, the doors shall begin to close.
   6. Door Open Watchdog: If the doors are opening, but do not fully open after a field adjustable time, the doors shall recycle closed then attempt to open six times to try and correct the fault.
   7. Door Close Watchdog: If the doors are closing, but do not fully close after a field adjustable time, the doors shall recycle open then attempt to close six times to try and correct the fault.
   8. Door Close Assist: When the doors have failed to fully close and are in the recycle mode, the door drive motor shall have increased torque applied to possibly overcome mechanical resistance or differential air pressure and allow the door to close.

B. Door Protection Device: Provide a door protection system using microprocessor controlled infra-red light beams. The beams shall project across the car opening detecting the presence of a passenger or object. If door movement is obstructed, the doors shall immediately reopen.

2.12 CAR OPERATING STATION

A. Car Operating Station, General: The main car control in each car shall contain the devices required for specific operation mounted in an integral swing return panel requiring no applied faceplate. Wrap return shall have a No. 4 brushed stainless steel finish. The main car operating panel shall be mounted in the return and comply with handicap requirements. Pushbuttons that illuminate using long lasting LED's shall be included for each floor served, and emergency buttons and switches shall be provided per code. Switches for car light and accessories shall be provided.

B. Emergency Communications System: Integral phone system provided.

C. Auxiliary Operating Panel: Not Required

D. Column Mounted Car Riding Lantern: A car riding lantern shall be installed in the elevator cab and located in the entrance. The lantern, when illuminated, will indicate the intended direction of travel. The lantern will illuminate and a signal will sound when the car arrives at a floor where it will stop. The lantern shall remain illuminated until the door(s) begin to close.

E. Special Equipment: Not Applicable

2.13 CONTROL SYSTEMS

A. Controller: Shall be integrated in a hoistway entrance jamb. Should be microprocessor based, software oriented and protected from environmental extremes and excessive vibrations in a NEMA 1 enclosure. Control of the elevator shall be automatic in operation by means of push buttons in the car numbered to correspond to floors served, for registering car stops, and by "up-down" push buttons at each intermediate landing and "call" push buttons at terminal landings.

B. Service Panel - to be located outside the hoistway in the controller entrance jamb and shall provide the following functionality/features:
   1. Access to main control board and CPU
   2. Main controller diagnostics
   3. Main controller fuses
   4. Universal Interface Tool (UIT)
   5. Remote valve adjustment
   6. Electronic motor starter adjustment and diagnostics
   7. Operation of pit motorized shut-off valve with LED feedback to the state of the valve in the pit
   8. Operation of auxiliary pump/motor (secondary hydraulic power source)
   9. Operation of electrical assisted manual lowering
   10. Provide male plug to supply 110VAC into the controller
   11. Run/Stop button

C. Automatic Light and Fan shut down: The control system shall evaluate the system activity and automatically turn off the cab lighting and ventilation fan during periods of inactivity. The settings shall be field programmable.

D. Emergency Power Operation: Full automatic operation (Simplex 10-D4A) Upon loss of the normal power supply, building-supplied standby power is available to the elevator on the same wires as the normal power. Once the loss of normal power has been detected and standby power is available, the elevator is lowered to a pre-designated landing and will open the doors.

After passengers have exited the elevator, the doors are closed. At this time the elevator is automatically allowed to continue service using the building-supplied standby power.

E. Special Operation: Not Applicable

2.14 HALL STATIONS

A. Hall Stations, General: Provide buttons with white-illuminating or blue-illuminating LED halos to indicate that a call has been registered at that floor for the indicated direction. Provide 1 set of pushbutton risers.
   1. Provide one pushbutton riser with faceplates having a No. 4 brushed stainless steel finish.
      a. Phase 1 firefighter's service key switch, with instructions, shall be incorporated into the hall station at the designated level.

B. Floor Identification Pads: Provide door jamb pads at each floor. Jamb pads shall comply with Americans with Disabilities Act (ADA) requirements.

C. Hall Position Indicator: Not Applicable

D. Hall lanterns: Not Applicable

E. Special Equipment: Not Applicable

2.15 MISCELLANEOUS ELEVATOR COMPONENTS

A. Oil Hydraulic Silencer: Install multiple oil hydraulic silencers (muffler device) at the power unit location. The silencers shall contain pulsation absorbing material inserted in a blowout proof housing.

B. Lockable three phase circuit breaker with auxiliary contact with shunt trip capability to be provided. Circuit breaker to be located behind locked panel (Group 2 security access) at controller landing entrance jamb and should be sized according to the National Electrical Code.

C. Lockable single phase 110V circuit breaker for cab light and fan to be provided. Circuit breaker to be located behind locked panel (Group 2 security access) at controller landing entrance jamb should be sized according to the National Electrical Code

2.16 CAR EQUIPMENT AND MATERIALS

A. Elevator Car, No. 2:
   1. Car Operating Panel: Provide main; flush-mounted applied face plate, with illuminated call buttons corresponding to floors served with "Door Open/Door Close" buttons and alarm button.
      a. Panel Material: Integral with front return; one per car.
      b. Car Floor Position Indicator: Above car operating panel with illuminating position indicators.
      c. Locate alarm button where it is unlikely to be accidentally actuated; not more than 54 inch above car finished floor.
      d. Provide following within service cabinet as part of car operating panel:
         1) Switch for each auxiliary operational control, keyed.
         2) Switches for fan, light, and inspection control.
         3) Emergency light.
   2. Flooring: Resilient vinyl tile.
   3. Front Return Panel: Match material of car door.
   4. Door Wall: Stainless steel.
   5. Side Walls: Plastic laminate on plywood.
   6. Rear Wall: Plastic laminate on plywood.

7. Hand Rail: Stainless steel, at all three sides. Provide open clearance space 1-1/2 inch (38 mm) wide to face of wall.
   a. Stainless Steel Finish: No. 4 Brushed.
8. Ceiling:
   a. Canopy Ceiling: Stainless steel.
   b. Lighting: LED downlights.
9. Provide emergency access panel for egress from car at ceiling.

B. Car Accessories:
   1. Certificate Frame: Stainless steel frame glazed with clear tempered glass, and attached with tamper-proof screws.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting this work.

B. Verify that hoistway and pit are ready for work of this section.

C. Verify hoistway shaft and openings are of correct size and within tolerance.

D. Verify that electrical power is available and of correct characteristics.

3.02 PREPARATION

A. Arrange for temporary electrical power for installation work and testing of elevator components. Comply with requirements of Section 01 50 00 - Temporary Facilities and Controls.

B. Maintain elevator pit excavation free of water.

3.03 INSTALLATION

A. Coordinate this work with installation of hoistway wall construction.

B. Install system components, and connect equipment to building utilities.

C. Provide conduit, electrical boxes, wiring, and accessories. Refer to Sections 26 05 33.13 and 26 05 83.

D. Mount motors on vibration and acoustic isolators.
   1. Prevent lateral displacement.

E. Install hoistway, elevator equipment, and components in accordance with approved shop drawings.

F. Install guide rails to allow for expansion and contraction movement of guide rails.

G. Accurately machine and align guide rails, forming smooth joints with machined splice plates.

H. Bolt or weld brackets directly to structural steel hoistway framing.

I. Field Welds: Chip and clean away oxidation and residue with wire brush; spot prime with two coats.

J. Install hoistway door sills, frames, and headers in hoistway walls; grout sills in place, set hoistway floor entrances in alignment with car openings, and align plumb with hoistway.

K. Structural Metal Surfaces: Clean surfaces of rust, oil or grease; wipe clean with solvent; prime with two coats.

L. Adjust equipment for smooth and quiet operation.

3.04 TOLERANCES

A. Guide Rail Alignment: Plumb and parallel to each other in accordance with ASME A17.1 and ASME A17.2.

B. Car Movement on Aligned Guide Rails: Smooth movement, without any objectionable lateral or oscillating movement or vibration.

3.05 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Perform testing and inspection in accordance with requirements.
   1. Inspectors shall be certified in accordance with ASME QEI-1.
   2. Perform tests in accordance with ASME A17.2.
   3. Provide at least two weeks written notice of date and time of tests and inspections.

C. Advise Owner, Contractor, Architect, and governing authorities in advance of dates and times tests are to be performed on the elevator.

3.06 ADJUSTING

A. Adjust for smooth acceleration and deceleration of car to minimize passenger discomfort.

B. Adjust with automatic floor leveling feature at each floor landing to reach 1/4 inch maximum from flush with sill.

3.07 CLEANING

A. Remove protective coverings from finished surfaces.

B. Clean surfaces and components in accordance with manufacturers written instructions.

3.08 CLOSEOUT ACTIVITIES

A. See Section 01 77 00 - Closeout Procedures, for closeout submittals.

B. See Section 01 79 00 - Demonstration and Training, for additional requirements.

C. Demonstrate proper operation of equipment to Owner's designated representative.

D. Demonstration: Demonstrate operation of system to Owner's personnel.
   1. Use operation and maintenance data as reference during demonstration.
   2. Briefly describe function, operation, cleaning and maintenance of each component.

E. Training: Train Owner's personnel on cleaning and operation and maintenance of system.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of two hours of training.
   3. Instructor: Manufacturer's training personnel.
   4. Location: At project site, unless noted otherwise.

3.09 PROTECTION

A. Do not permit construction traffic within car after cleaning.

B. Protect installed products until Date of Substantial Completion.

C. Touch-up, repair, or replace damaged products and materials before Date of Substantial Completion.

3.10 MAINTENANCE

A. Provide Initial Maintenance Contract of elevator system and components in accordance with ASME A17.1 and requirements as indicated for 12 months from Date of Substantial Completion.

B. Perform maintenance contract services using competent and qualified personnel under the supervision and direct employ of the elevator manufacturer or installer.

C. Maintenance contract services shall not be assigned or transferred to any agent or other entity without prior written consent of Owner.

D. Examine system components monthly.

E. Include systematic examination, adjustment, and lubrication of elevator equipment.

F. Maintain and repair or replace parts, whenever required, using parts produced by original equipment manufacturer.

G. Perform work without removing cars from use during peak traffic periods.

H. Provide emergency call back service during regular working hours throughout period of this maintenance contract.

I. Maintain an adequate stock of parts for replacement or emergency purposes, and have personnel available to ensure the fulfillment of this maintenance contract without unreasonable loss of time.

END OF SECTION

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SECTION 21 00 00
FIRE SUPPRESSION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including the Conditions of the Contract (General, Supplementary and other Conditions, if any) and all other applicable Divisions, apply to work of this Section.

B. This specification or drawing and the design features or resulting construction disclosed, are the property of Furlow Associates, Inc., and shall not be reproduced without written permission.

C. All fire protection suppression systems shall be part of and included in all of the Division 22 Sections.

1.2 WORK INCLUDED

A. Provide labor, materials, equipment and supervision necessary to install complete operating Fire Protection Systems as indicated the drawings and specified herein, including all work at the site and within the proposed construction areas to accomplish the required work.

1.3 REGULATIONS, CODES AND STANDARDS

A. Work shall be performed in accordance with latest adopted codes, regulations and ordinances by authorities having jurisdiction. Observe all safety regulations.

B. Latest editions of any referenced standards shall govern.

C. Obtain all municipal and/or the Authorities Having Jurisdiction permits and inspection certificates and pay all charges.

D. Make or arrange for any/or all inspection agency reviews or visits and pay all charges. This includes communication with each respective agency and/or utility to verify the project system work, coordination responsibilities, fees, back charges, etc., required.

E. All fees and back charges shall be verified during the bidding phase of the work. Any discrepancy of this item between any utility, inspection agency and the Contractor shall be brought to the attention of the A/E prior to bid opening.

F. Submission of a bid will be deemed evidence of having complied with these requirements.

1.4 RELATED WORK

A. Refer to equipment shown or specified in all other applicable Divisions that require Fire Protection services.

B. Refer to work related to Fire Protection as shown on the following contract drawings:

Architectural & Structural

HVAC

Electrical

1.5 COORDINATION

A. The Mechanical, Plumbing and Electrical Contractors are responsible to coordinate all manufacturer's recommended circuit breakers, starters, disconnects and fuse sizes for all equipment. Submission of a shop drawing will certify that this has been completed. Any necessary changes required will be included as part of this contract.

B. Sprinkler Contractor shall coordinate scheduling, submittals and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of independent work elements, with provisions to accommodate items that may be installed at a later time.

C. Sprinkler Contractor shall verify utility requirements and all characteristics of operating equipment are compatible with the building utilities. Coordinate the work of all sections related and required for installing, connection and placing in service of all equipment.

D. Sprinkler Contractor shall coordinate all space requirements, supports and installation of all mechanical, electrical, plumbing and fire protection work, which are indicated diagrammatically on the Drawings. Verify routing of all pipes, ducts, conduits and equipment connections. Maximize accessibility for other work, and service requirements for maintenance and repairs. Develop overall coordination drawing (all trades) and submit for review prior to fabrication/installation.

E. Obtain written confirmation from all related trade Contractors and the Owner or his representative that requirements, conflicts and coordination issues have been discussed and resolved.

F. Coordination of Trades in the Field: The Sheet Metal Contractor shall take precedence and, therefore, shall develop his shop drawings first. These then will be used to overlay the other trades. Next shall be the mechanical piping, plumbing, fire sprinkler and electrical in the order stated. Drawings shall be 3/8" in scale. Initial meeting of contractors shall be convened prior to start of drawings to work out layout, breakdown of building and other details. All drawings shall be completed in CAD with a format compatible and convertible to DWG files. At the end of the effort, each contractor shall provide a full set of shop drawings to each of the other contractors and three sets to the construction manager. Devices requiring access for maintenance shall not be infringed upon by adjacent trades.

1.6 SUBMITTALS

A. Shop Drawings & Product Data:

1. Shop drawings and product data shall be submitted in accordance with Division 21 specifications except where herein modified.

   NOTE: Submittals will only be reviewed once and resubmittals will be reviewed once. Any other submittals will be billed to the Contractor at the Engineer's standard rates.

2. Listed are the required shop drawings and reports required for this project. The Engineer/Owner shall reserve the right to require additional submissions not listed below:
   - All equipment and associated devices so listed on the Drawings.
   - All specified piping systems.
   - All specified valves.
   - Gauges
   - Hanger and supports
   - Piping labels and identification.
   - Sprinkler System and all related data, devices, switches and trimmings.
   - Testing reports.
   - Operating/Maintenance manuals.
   - As-Built Drawings.

3. Submittals comprising complete catalog cuts, shop drawings and performance test data for Plumbing materials and equipment as required by other sections of Division 22, shall be submitted for review checking. The Contractor shall review these for conformance to contract documents prior to submission and affix contractor's signature to each submittal certifying that this review has been done. By approving and submitting shop drawings, product data, samples and similar materials, the Contractor represents that the Contractor has determined and verified materials, field measurements and field construction data that relates to the work, and has checked and

coordinated this information with all of the requirements contained in the contract documents for the work of all trades.

4. All submittals shall have the following identification data, as applicable, contained therein or permanently adhered thereto.
   a. Project name.
   b. Project number.
   c. Sub-contractor's, vendor's and/or manufacturer's name and address.
   d. Product identification.
   e. Identification of deviation from contract documents.
   f. Applicable contract drawings and specification section number.
   g. Shop drawing title, drawing number, revision number, and date of drawing and revision.
   h. Resubmit revised or additional submittals as requested.
   i. Wherever shop drawings or vendor's standard data sheets indicate work to be done "by others", it shall be the responsibility of the contractor making the submission to identify by name, the contractor who is to do this work. If the contractor named is other than the contractor making the submission, the shop drawing submission must be reviewed by the named contractor and bear his mark of approval, prior to submission to the Architect/Engineer.
   j. Where equipment proposed differs from that shown on the drawings or specified, he shall submit for approval drawings showing the manner in which the layout is affected by the substitution.
   k. The Contractor shall keep one copy of approved shop drawings at the job site,, filed in a suitable metal container. The shop drawings shall be cataloged and kept in good repair, and shall be available for use by the Owner, Architect and Engineer.
   l. No equipment shall be ordered, fabricated, etc., before approval of shop drawings.

B. Contractor is responsible for the shop drawing coordination and interface with the work of other contracts and adjacent work. The relationship of Contractor’s work shall be verified as it relates to adjacent and critical features of the work of this and all contracts and materials.

1.7 WARRANTY/GUARANTEE

A. All work and materials are subject to the general warranty as described in the General Conditions of the Contract and in all other applicable Divisions. In addition, refer to specifications for special guarantees.

B. Wherever in the specification sections of this division, reference is made to a specific warranty period, this warranty shall be in addition to and not a limitation of other rights the Owner may have against the Contractor under the contract documents.

C. Contractor to include an 11 month “walk-thru” of the building systems with representatives of the School District, Architect, Engineer and the Construction Manager. The purpose is to establish a list of corrective work that relates to operational issues, material/installation deficiencies.

1.8 SITE INSPECTION

A. The Contractor shall visit the site, inspect, and become aware of all conditions which may affect the work during the estimation phase of his work and prior to bid openings. Investigate utilities, protection requirements for adjacent facilities, storage locations, and access to the construction area.

B. Submission of a bid will be deemed evidence of having complied with this requirement.

1.9 SUBSTITUTIONS

A. Whenever a material, article, piece of equipment or system is identified in the following specification or indicated on the drawings by reference to manufacturers' or vendors' names, trade names, catalog numbers or the like, it is so identified for the purpose of establishing the basis of the Bid.

B. Substitution approval must be obtained and included as an addendum item prior to the submission of the bid. An approved substitution shall not be considered as an approval for the Contractor or an equipment vender to deviate from the written portion of the specifications unless so stated in the addendum.

C. The drawings illustrate the space allocated for equipment and the Contractor shall install the equipment accordingly. If changes are required in the building or arrangement due to substitution of equipment, the Contractor making the substitution must pay for the necessary modifications.

D. The listed equivalent or substituted manufacturers along with the bidding related contractor shall be completely responsible to comply with all requirements as indicated on all contract documents and as described within the specifications. This shall include, but shall not be limited to space requirements, code clearances, the type, horsepower, capacities, number and size of services required from other trades, including all required ancillary items furnished and installed by other trades. If the manufacturer or related bidding contractor does not comply with these requirements, then they shall be responsible for any and all additional costs associated with the changes required by other trades.

1.10 LUBRICATION

A. Furnish, install and maintain all required lubrication of any equipment operated prior to acceptance by the Owner. Lubrication shall be as recommended by the equipment manufacturer.

B. Provide one year's supply of lubricants to Owner at date of acceptance.

C. Verify that required lubrication has taken place prior to any equipment start-up.

1.11 EQUIPMENT START-UP

A. Verify proper installation by manufacturer or his representative.

B. Advise General Contractor 2 days prior to actual start-up.

C. Verify proper operation. Obtain signed statement by manufacturer or his representative that equipment is operating within warranty requirements. Submit statement to General Contractor.

1.12 OPERATION & MAINTENANCE INSTRUCTIONS

A. Properly and fully instruct Owner's personnel in the operation and maintenance of all systems and equipment.

B. Insure that the Owner's personnel are familiar with all operations to carry on required activities.

C. Such instruction shall be for each item of equipment and each system as a whole.

D. Provide report that instruction has taken place. Include in the report the equipment and/or systems instructed, date, contractor, Owner's personnel, vendor, and that a complete operating and maintenance manual has been reviewed.

E. Manual shall include all instructions on operation, maintenance, repair parts list, lubrication requirements, brochures, catalogue cuts, wiring diagrams, piping diagrams, control sequences, service requirements, names and addresses of vendors, suppliers and emergency contacts. Three manuals shall be provided.

F. Submit manuals for review prior to operating instruction period. Manuals shall be 8-1/2 x 11" with hard cover, suitably bound.

G. Provide to the Owner any special tools necessary for operation and routine maintenance of any of the equipment.

H. Furnish three (3) copies of a professionally taped video and three (3) copies of professionally prepared drawings demonstrating the following:

- Location of main shut-off valves
- Procedures for equipment start-up and seasonal shut-downs.
- Procedures for maintenance.
- Provide written version of all procedures included in video.

The above should cover all equipment/systems including, but not limited to the following:

- Sprinkler Systems

1.13 TOOLS

A. All equipment furnished by the Contractor which requires special tools or devices other than those normally available to the maintenance or operating staff shall be furnished in duplicate to the Owner, sufficiently marked, packed or boxed for staff usage. The tools provided shall be listed by the Contractor identified as to their use or the equipment applicable in a written transmittal to the Owner.

1.14 CLEANING AND FINISHING

A. After equipment start-up and all operating tests have been made and the system pronounced satisfactory, each respective Contractor shall go over the entire project, clean all equipment, etc., installed by him and leave in a clean and working condition. Any surfaces found marred after this final cleaning shall be refinished or replaced by each Contractor at no cost to the Owner.

B. Provide for the safety and good condition of all materials and equipment until final acceptance by the Owner. Protect all materials and equipment from damage. Provide adequate and proper storage facilities during the progress of the work. Special care shall be taken to provide protection for bearings, open connections, pipe coils, pumps, compressors and similar equipment.

C. All NEW fixtures, piping, finished surfaces and equipment installed shall have all grease, adhesive labels and foreign materials removed.

D. All new piping installed shall be drained and flushed to remove grease and foreign matter. Remove and thoroughly clean and reinstall all liquid strainer screens after the system has been in operation ten (10) days.

E. When connections are made to existing systems, the Contractor shall do all cleaning and purging of the existing systems required to restore them to the condition existing prior to the start of work.

F. Clean-up: Remove from the premises, all unused material and debris resulting from the performance of work under this section.

PART 2 – PRODUCTS

2.1 GENERAL

A. All material and equipment shall be new and of present day manufacture, and shall conform to accepted standards of the trade where such a standard has been established for the particular type of equipment or material.

B. Whenever equipment or material is referred to in the singular, such as "the plumbing fixture", it shall be deemed to apply to as many such items as necessary to complete the work.

2.2 PRODUCT DELIVERY, STORAGE AND HANDLING

A. During loading, transporting and unloading exercise care to prevent damage to material.

B. Store all materials in dry enclosures or under protective coverings out of way of work progress.

C. Material shall not be allowed to be stored directly on ground.

D. Deliver in manufacturer's original cartons or on skids.

E. Handle and protect so as to prevent damage to product or any surrounding material.

2.3 CONCRETE

A. Concrete if used on this project, shall be in accordance with Division 03 Concrete.

B. The 28-day minimum compressive strength shall be 3000 psi.

PART 3 – EXECUTION

3.1 PROTECTION

A. Plug or cap open ends of piping systems.

B. Stored materials shall be covered to prevent damage by inclement weather, sun, dust or moisture.

C. Protect all installed work until accepted in place by the Owner.

D. Plates, polished metal escutcheons and other finished devices shall not be installed until masonry, tile, and painting operations are complete unless otherwise protected.

E. Protect all work from operations which may cause damage such as hauling, welding, soldering, painting, insulating and covering.

F. Do not remove protective material until equipment is placed in service.

3.2 WORKMANSHIP

A. Install all work neat, trim and plumb with building lines.

B. Install work in spaces allocated.

C. Cutting and patching shall be performed by skilled tradesmen normally employed for the work involved.

3.3 EXCAVATION

A. The excavation shall be of the open-trench method and to the depths and widths as may be necessary. The Contractor shall do all excavation required in connection with his work. Bottoms of trenches shall be excavated to a uniform grade. All materials excavated shall be deposited on the side of the trenches and beyond the reach of the slides. Excavated material shall not be piled where it will interfere with traffic. If rock is encountered, it shall be removed by the General Contractor. See provisions in Division 2.

B. No piping shall be bedded directly on rock. They shall be cushioned by a 6-inch layer of crushed stone or gravel of selected grade, of size to pass through 3/4" mesh sieve. Not less than 30% shall be fine which will pass through a 3/8" mesh sieve.

3.4 SHORING AND PUMPING

A. The Contractor shall provide all shoring, bracing or sheet piling necessary to maintain the banks of his excavation and shall take out same as the work progresses and filling in has been accomplished. Shoring shall be in accordance with OSHA Standards.

B. The arrangement of shoring must be such as to prevent any movement of the trench banks and consequent strains on the conduits. Shoring shall be provided to prevent damage to work installed by other trades.

C. The Contractor shall do all pumping required to keep his excavations free of water. The water shall be conveyed in piping or watertight troughs a sufficient distance that it will flow from the site and not affect other work being performed.

3.5 BACKFILLING

A. After work in trenches has been completed, they shall be filled with select fill in 8" layers and shall be pneumatically tamped before the next layer of material has been filled in. The backfill shall be free of excavated rock, cinders, stones, brickbats or other debris.

B. Wherever rock is removed, the Contractor shall secure and fill select clean earth to a minimum depth of 3'-0" above the top of the pipe. Unless otherwise indicated, no rock shall be deposited in the trench fill. This clean earth fill shall be procured other than from the site unless permission for earth borrow from the site is granted by the Architect. If site borrow is permitted, the topsoil removal, relocation and finished grading will be accomplished as directed by the Architect.

C. Under no circumstances shall excavated material be left where it will interfere with the Owner's or other Contractor's operations.

D. All earth and other materials taken from the trenches and not required for backfilling shall be deposited where directed, or removed from the premises as directed by the Architect.

E. Any rock removed from the excavation shall be removed from the project site by the Contractor.

F. Trenches which pass under wall footings or within 18" of column footings shall be backfilled with lean concrete. To secure adequate foundation support, the method and depositing of the concrete fill shall be as directed by the Architect. To prevent the concrete from adhering to the pipes, necessary pipe protection shall be applied.

3.6 EQUIPMENT SETTING

A. Furnish and install as a minimum, a 4-inch concrete pad beneath all floor-mounted equipment. Install anchor bolts in pour.

B. Furnish and install as a minimum, spring vibration isolation under any equipment 10 HP and over and rubber in shear vibration isolation on any equipment up to 10 HP.

C. Concrete shall be 3,000 psi, 28-day compressive strength in accordance with ACI-613. Reinforce with No. 4 rod 12" on centers both ways or as otherwise detailed.

3.7 FASTENERS, HANGERS AND SUPPORTS

A. Furnish and install all hangers and supports required to suspend, mount, or hang the work.

B. Furnish and install all miscellaneous steel angles, channels, beams, clips, brackets and anchors necessary to hang or support the work. Provide submissions for review.

C. Install concrete inserts before concrete is poured.

D. Drilled inserts shall not be loaded more than 1/4 rated capacity or 200 pounds.

E. Power-driven fasteners shall not be allowed for piping larger than 2 inch, or equipment. When used they shall not be loaded more than 1/8 rated capacity or 200 pounds.

F. All hangers, miscellaneous steel, braces and supports shall be galvanized, cadmium plated, or primed steel. Copper tubing shall be supported with copper hangers. No direct contact of dissimilar metals between the piping system and its hanger support shall be permitted.

G. Piping shall be supported from adjustable clevis type hangers with insulation pipe saddles. Where hangers are 18” or longer, provide lateral bracing at every fourth hanger

H. Support vertical piping at floor levels using approved riser clamps. Clamp material shall be compatible with pipe material. Maximum vertical spacing shall be10’-0”.

I. All supports and hangs and spacing of such shall be in accordance with NFPA 13.

3.8 SLEEVES

A. Provide each pipe passing through a masonry or concrete wall, floor or partition with a sleeve made from standard weight steel pipe for pipe with smooth edges, securely and neatly cemented in place. Provide each pipe passing through a frame or metal partition with a sleeve made from No. 22 gauge galvanized sheet metal, securely fastened in place.

B. Pipe passing through foundation wall or under foundation shall be provided with relieving arch or steel pipe per IPC Section 305.5.

C. Be responsible for the proper location and alignment of all sleeves.

D. Provide hydrostatic seals for sleeves passing through outside walls, below grade, or through hydrostatically sealed slabs or floors on grade. Provide fire-rated seals for all other sleeves.

E. Install both piping and sleeve seals so as to maintain integrity of seals with expansion and contraction of piping.

F. Set floor sleeves flush with floor surface in finished areas, 1" above the finished floor in kitchens, cafeterias, and similar service areas unless such areas are slab-on-grade; 1" above the floor in mechanical rooms, pipe chases, pipe spaces and other unfinished areas, unless otherwise indicated, and flush with the underside of slabs. Extend wall and partition sleeves through and cut flush with each surface unless otherwise indicated or specified.

G. Select sleeves two pipe sizes larger than any pipe that is to remain uncovered, unless otherwise required by the sealing method specified. Where pipes are to be covered, provide sleeves large enough to allow the covering to pass through the sleeves with sufficient clearance for sealing as specified hereinafter. Size sleeves for branch piping from vertical risers large enough to permit vertical expansion at the riser.

H. Place sleeves imbedded in concrete floors or walls in the forms before concrete is poured; sleeves shall have integral waterstop flanges, where they are to receive either watertight or hydrostatic seals.

I. Install sleeves passing through above-grade floors of mechanical rooms, toilet rooms, kitchens or similar service areas where liquid leaks or spillover may occur in a watertight manner. Sleeves shall be such that waterproofing membrane can be flashed around and into the sleeve where necessary.

J. Seal sleeves for pipes passing through ceiling air plenum walls or the floor above air tight in a manner similar to that specified for fire-rated sleeves.

K. Hydrostatic Sealing Method: Provide compressible synthetic rubber seals, equivalent to LINK SEAL, manufactured by the Thunderline Corporation, or THRUWALL manufactured by O.Z. Gedney. Install seals in accordance with the manufacturer's recommendations to provide air tightness aboveground and hydrostatic sealing belowgrade. Caulking or other type mastic is not acceptable.

L. Fire-Rated Sealing Method:

1. Sleeves, openings and sealants shall comply with applicable codes, recommended practices and standards, and manufacturer's instructions. Fire sealants shall have ability to prevent spread of flame, smoke or water throughout the penetration and shall pass 3 hour test, UL test ASTM E814 and UL 1479.

2. Products: Chase Corporation CTC PR-855, O. Z. Gedney CRS/CAFS, 3M Electro-Products Division Putty 303 or Caulk CP25 penetration sealing kits, General Electric Company sealants type RTV-850, 6428 or 7403, Thunderline Corporation "Link-Seal Pyro-Pak". Installation and type of sealant to be used as recommended by the manufacturer.

3. Expansion collars, fire seal/firestop collars – ASTM E814 (UL1479). Spec Seal Corporation, Inc. (plastic pipe).

3.9 PLATES

A. Furnish and install chrome plated plates wherever piping passes into finished area.

B. Plates shall be securely fastened to piping or building construction.

C. Floor plates shall cover 1 inch sleeve extension.

3.10 OFFSETS, TRANSITIONS, MODIFICATIONS

A. Furnish and install all offsets necessary to install the work and to provide clearance for other trades.

B. Maintain adequate headroom and clearance.

C. Incidental modifications necessary to the installation of the systems shall be made as necessary and as approved by the Architect.

3.11 RECESSES

A. Furnish information to the General Contractor as to sizes and locations of recesses required to install panels, boxes, and other equipment or devices which are to be recessed in walls.

B. Make offsets or modifications as required to suit final locations.

3.12 LABELING

A. All Plumbing equipment such as pumps, and devices requiring identification for operating procedures shall be provided with permanent black laminated micarta white core labels with 3/8 inch letters.

B. This shall also apply to all controllers, remote start/stop pushbuttons and equipment cabinets.

3.13 FLASHING AND COUNTERFLASHING

A. Roof drains, vents, roof curbs, etc., shall have counterflashing fittings. General Contractor shall provide flashing.

B. Piping and conduit thru the roof shall be flashed by the General Contractor. Furnish and install counterflashing.

3.14 ACCESS

A. Locate all equipment, valves, devices and controllers which may need service in accessible places.

B. Where access is not available, access panels shall be provided. Furnish access doors to the General Contractor for installation.

C. Access doors shall be Elmdor, Karp Co., MIFAB or Controlled Air Manufacturing Limited, with 16 gauge frames and 14 gauge steel door, prime painted.

D. Maintain required access clearances.

3.15 WIRING

A. Packaged plumbing system equipment shall be furnished with disconnect switches, and magnetic starters, factory furnished and wired by the unit manufacturer.

B. All control wiring shall be furnished and installed under this Division of the work.

C. All wiring shall be in accordance with the National Electrical Code and as recommended by the equipment manufacturer.

3.16 UTILITIES

A. Do not interrupt any utility or service to the Owner without adequate previous notice and schedule.

B. Arrange and pay for the relocation, disconnection or removal of, or relocate, disconnect or remove existing utilities and services where such work is shown or where such utilities or services interfere with new construction, whether or not shown. Provide all excavation, backfilling and paving required by such work.

C. Perform alteration of utilities and services in accordance with the rules, regulations and requirements of the involved utility companies, regulatory agencies having jurisdiction.

3.17 CUTTING AND PATCHING EXTERIOR SURFACES

A. This Contractor shall be responsible for returning disturbed paved and/or grass areas to original condition where excavation for utilities has been required.

B. Cut and patch paved areas to match original surface.

C. Properly tamp backfill before finishing or repairing disturbed area surfaces.

3.18 OPENINGS - CUTTING, REPAIRING

A. This contractor shall cooperate with the work to be done under other sections in providing information as to openings required in walls, slabs and footings for all piping and equipment, including sleeves where required.

B. Any drilling or cutting required for the performance of work under this Section, shall be the responsibility of this Contractor and the cost thereof shall be borne by him.

C. Holes in Concrete: Sleeves shall be furnished, accurately located and installed in forms before pouring of concrete. This contractor shall pay all additional costs for cutting of holes as the result of the incorrect location of sleeves. All holes through existing concrete shall be either core drill or saw cut. All holes required shall have the approval of the Structural Engineer prior to cutting or drilling.

D. It shall be the responsibility of this Contractor to ascertain that all chases and openings are properly located.

3.19 GUARANTEE

A. All materials and equipment provided and/or installed under this section of the specifications shall be guaranteed for a period of one year from the date of acceptance of the work by the Owner unless otherwise specified in other applicable Divisions. Should any trouble develop during this period due to defective materials or faulty workmanship, the Contractor shall furnish all necessary labor and materials to correct the trouble without any cost to the Owner. Any defective materials or inferior workmanship noticed at time of installation and/or during the guarantee period shall be corrected immediately to the entire satisfaction of the Owner.

In the event of occupancy by the Owner prior to final acceptance of the project, the guarantee date for equipment placed in operation shall be mutually agreed to by the Contractor and the Owner's representative.

B. Contractor to include an 11 month “walk-thru” of the building system with representatives of the School District, Architect, Engineer and the Construction Manager. The purpose is to establish a list of corrective work that relates to operational issues, material/installation deficiencies.

3.20 DRAWINGS

A. The Fire Protection Systems are indicated on the Contract Drawings. Certain pertinent information and details required by the Fire Protection Work appear on the Architectural, Structural and Electrical Drawings; become familiar with all Drawings; and incorporate all pertinent requirements.

B. Drawings are diagrammatic and indicate the general arrangement of systems and requirements of the Work. Do not scale Drawings. Exact locations of fixtures and equipment, not specifically shown shall be obtained before starting work.

3.21 RECORD DRAWINGS

A. As-Built record drawings, showing dimensions, locations and depth of all buried and concealed piping, plugged outlets and equipment shall be kept up to date. Master copy shall be kept on the job. No backfilling of trenches shall be permitted until as-built drawings are approved as up-to-date by the Owner/Representative. No plumbing progress payments shall be approved unless as-built drawings are up- to-date. Depth of sewers shall be from a permanent bench mark as shown on the contract drawings. Refer to project record drawings under General Conditions.

END OF SECTION

SECTION 21 13 00

FIRE SUPPRESSION SPRINKLER AND STANDPIPE SYSTEMS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The drawings and general provisions of the Contract, including the Conditions of the Contract (General, Supplementary and other Conditions, if any) and Division 1 as appropriate, apply to the work specified in this Section.

B. Codes and Standards listed below, apply to work indicated on the drawings and in the specifications.

1. National Fire Protection Association (NFPA)
2. Delaware State Fire Prevention Regulations (DSFPR)
3. American National Standards Institute (ANSI)
4. American Society for Testing Materials (ASTM)
5. National Electrical Manufacturer's Association (NEMA)
6. Underwriters' Laboratories (UL)

1.2 DESCRIPTION OF WORK

A. This Section shall include all work necessary and/or required and furnish all materials and equipment for construction of a complete automatic sprinkler system (and fire standpipe system) for the building areas indicated. Such work includes but is not limited to the following:

1. UL/FM labeled equipment.
2. Connection to water supply provided by Plumbing Contractor.
3. Installation of fire department connection.
4. All piping and equipment required for a complete wet sprinkler system on occupied floor levels.
5. Installation of tamper and flow switches.
6. Installation of riser check valve assembly.
7. Installation of backflow preventer.
8. All piping and equipment for a complete wet fire standpipe system.
9. To coordinate with the Mechanical, Plumbing and Electrical Contractors, the installation of the mains and sprinkler piping and supports to allow installation of their work with maximized accessibility for these trades and service requirements for maintenance and repair. Prior to installing any piping or other devices, obtain written conformation from these contractors that requirements, conflicts and coordination issues have been discussed and resolved. Provide system drawings with elevation of any piping or other systems to the Mechanical Contractor so he can prepare the necessary coordination drawings that may be required. No work may be installed until the coordination issues are resolved. Any and all expense relating to coordination issues shall be born by the Contractor who did not install his work according to the coordination drawings.

1.3 REFERENCE STANDARDS

A. Refer to Section 21 00 00 for a general description of requirements applying to this section.

1.4 QUALITY ASSURANCE

A. Refer to Section 22 05 00 for a general description of requirements applying to this section.

B. Sprinkler System Contractor shall provide complete sprinkler systems in satisfactory operating condition which shall conform to requirements of the following:

1. NFPA Pamphlet 13
2. NFPA Pamphlet 14
3. New Castle County Fire Marshal's Office
4. Owner's Insurance Agency
5. Owner’s Standards

C. Submit working drawings to the New Castle County Fire Marshal's Office and obtain approval before beginning work.

D. Sprinkler systems shall be “Light Hazard Occupancy", unless noted otherwise, and shall cover all rooms, closets, attic spaces, etc., in the entire building.

1. Design and layout shall be based on Calculated System (Hydraulic).
2. Exact routing of piping shall be governed by structural conditions and obstructions.
3. The Sprinkler Contractor shall coordinate his work with the other trades so as to clear all construction items, lights, ducts, piping, etc.

1.5 SUBMITTALS

A. Submit shop drawings and product data in accordance with Section 21 00 00.

Submit shop drawings with Fire Marshal's approval and descriptive data, complete with product designation for the following:

1. Valves
2. Sprinkler Heads
3. Fire Department Hose Valves

B. Submit complete sprinkler layout indicating location of heads by dimensions from walls, pipe size, and locations of valves, fittings and accessories, with Fire Marshal's approval.

C. Submit manufacturer's product data on sprinkler heads, valves, fire department connections, air compressor, hangers, pipe, and fittings, etc.

1.6 WARRANTY/GUARANTEE

A. All work and materials are subject to the general warranty as described in the General Conditions of the Contract and in Division 1, GENERAL REQUIREMENTS.

1.7 TESTS AND INSPECTIONS

A. Contractor shall arrange and pay for all inspections, examinations and tests required by authorities specified herein and deliver certificates of such inspections to Owner.

B. Complete sprinkler system shall be tested in accordance with the latest requirements of NFPA Pamphlet 13 and the New Castle County Fire Marshal's Office.

C. Fire Marshal's acceptance test shall be performed before system is placed in service and not less than five working days after Fire Marshal is notified.

1.8 QUALIFICATIONS OF CONTRACTOR

A. Contractor for sprinkler installation shall be licensed by the State of Delaware and be regularly engaged in installation of automatic sprinkler systems and other fire protection equipment.

B. Consult General Provisions for additional requirement.

PART 2 – PRODUCTS

2.1 FIRE PROTECTION PIPING MATERIALS & PRODUCTS

A. Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by installer to comply with installation requirements. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in fire protection piping systems. Where more than 1 type of materials or products are indicated, selection is installer's option.

2.2 BASIC IDENTIFICATION

A. Provide identification complying with applicable Division 22 sections in accordance with the following listings:

1. Fire Protection Piping: Plastic pipe markers.
2. Fire Protection Valves: Metallic valve tags.

2.3 BASIC PIPE AND FITTINGS

A. Comply with the weight, size and type of pipe and fittings by the latest issued schedule of NFPA Pamphlet 13, adopted by Authorities having jurisdiction.

B. All fire protection piping within the Mechanical Room shall be minimum Schedule 40 black iron pipe.

C. Plastic piping shall not be permitted.

D. Uni-Flange type connections shall not be permitted on this project.

2.4 BASIC PIPING SPECIALTIES

A. Provide piping specialties complying with Section 22 05 00 in accordance with the following listing:

Pipe escutcheons

Dielectric unions

Drip pans

Sleeves

Sleeve seals

2.5 BASIC VALVES

A. Comply with the latest issue of NFPA 13 adopted by the Authorities having jurisdiction for the following:

Control Valve - OS&Y Valve

Check - Swing Valve

2.6 FIRE PROTECTION SPECIALTIES

A. Provide fire protection specialties, UL listed, in accordance with the following listing. Provide sizes and types which mate and match piping and equipment connections.

B. Automatic Sprinklers: Sprinkler heads shall be UL approved for intended use and have temperature ratings as indicated or required for location.

Provide the following type sprinkler heads as indicated:

Upright: Viking “Micromatic Model "M" bronze finish, 1/2" orifice.

Pendent: Viking “Micromatic Model "M" chrome plated, 1/2" orifice and escutcheon plate.

Pendent: Viking “Microfast Model “M” quick response with all white finish including escutcheon plate, ½” orifice.

Sidewall: Viking "Micromatic Model "M", chrome plate, ½" orifice.

Sidewall: Viking "Microfast Model "M" – quick response, all white finish including escutcheon plate, ½" orifice.

Sidewall: (Extended Coverage) Viking "Microfast Model "M", quick response, all white finish, extra large orifice.

Semi-Recessed: Viking "Silhouette Model A-1 quick response, chrome plated, ½" orifice.

Full Concealed: Viking "Horizon-Mirage" large orifice quick response, white cover plate.

Dry Sprinklers:

Upright: Viking "Model "M" plain barrel, ½" orifice bronze finish.

Pendent: Viking "Model "M", adjustable standard, all white finish, ½" orifice.

Pendent: Viking "Model "M" adjustable semi-recessed, all white finish, ½" orifice.

Sidewall: Viking "Model "M" adjustable standard, all white finish, ½" orifice.

Sidewall: Viking "Model "M" adjustable semi-recessed, all white finish, ½" orifice.

C. Sprinkler Cabinet and Wrench: Furnish steel, baked red enameled, sprinkler box with capacity to store 10 sprinklers and wrench sized to sprinklers.

2.7 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Specialty Valves and Devices:

   Vicatulic Company

   Tyco Fire Suppression & Building Products

   Reliable Automatic Sprinkler Co., Inc.

   Viking Corp.

2. Sprinklers:

   Tyco Fire Suppression & Building Products

   Reliable Automatic Sprinkler Co., Inc.

   Viking Corp.

   Victaulic Company

3. Fire Dept. Hose Valves:

   Potter-Roemer

   Elkhart

   Fire-End and Croker Corp.

   Guardian Fire Equipment, Inc.

   Fire Hose Valve Cabinets:

   Potter-Roemer

   Larsen

   Guardian Fire Equipment, Inc.

   Fire-End and Croker Corp.

4. Fire-Protection-Service Valves:
   Tyco Fire Suppression & Building Products
   Central Sprinkler Corp.
   Nibco, Inc.
   Stockham Valves & Fittings, Inc.
   Victaulic Company
5. Keyed Couplings for Steel Piping: (Grooved Fittings)
   Tyco Fire Suppression & Building Products
   Victaulic Company
   Viking Corp.
   Anvil International Grulok

PART 3 – EXECUTION

3.1 INSTALLATION OF BASIC IDENTIFICATION

A. Install fire protection signs on piping in accordance with ANSI/NFPA 13.

3.2 FIRE SPRINKLER PIPING SYSTEMS

A. Comply with requirements of ANSI/NFPA 13 for installation of fire sprinkler piping materials. Install fire sprinkler piping products where indicated, in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that fire sprinkler piping complies with requirements and serves intended purposes.

B. Coordinate with ceiling space available, other trades, including plumbing piping, as necessary to interface components of fire sprinkler piping properly with all other items of construction.

C. Install drain piping at low points of fire sprinkler piping.

D. Provide auxiliary drains as required.

E. Install system valve assemblies where indicated.

F. Install the following type sprinkler head in the following locations:

G. Exterior Sprinklers: Exterior sprinkler coverage and protection shall be provided for any canopy or soffit overhang construction.

H. Install sprinkler in acoustical tile suspended ceilings, in the center of the tile with heads installed in such a way that the requirements for both coverage and symmetry are fulfilled.

I. No portion of the wet sprinkler system shall be installed within the attic and/or potential freezing areas of the building without being provided with freeze protection.

J. Provide tamper and flow switches where indicated or noted. All switches shall be wired by the Fire Alarm System Contractor. Provide all coordination and communication with the Fire Alarm Contractor for number and relocation of all switches.

3.3 INSTALLATION OF SUPPORTS, ANCHORS AND SEALS

A. Comply with the latest issue of NFPA adopted by the Authorities having jurisdiction.

3.4 INSTALLATION OF FIRE PROTECTION SPECIALTIES

A. Comply with the latest issue of NFPA adopted by the Authorities having jurisdiction.

3.5 ADJUST & CLEAN

A. Sprinkler Piping Flushing: Prior to connecting sprinkler risers for flushing, flush water feed mains, lead-in connections and control portions of sprinkler piping. After fire sprinkler piping installation has

been completed and before piping is placed in service, flush entire sprinkler system, as required to remove foreign substances, under pressure as specified in ANSI/NFPA 13. Continue flushing until water is clear, and check to ensure that debris has not clogged sprinklers.

3.6 FIELD QUALITY CONTROL

A. Notify the Authority Having Jurisdiction, the Owner's Representative, and Architect & Engineer of time and date of scheduled testing. Provide minimum of 5-day prior notice of testing to allow for witnessing.

B. Perform all required system testing and acceptance requirements on the new (and modified) system installations in accordance with NFPA 13, 14, & 25, the Delaware State Fire Prevention Regulations, the Authorities Having Jurisdictions (AHJ) requirements and all other local codes and ordinances. At a minimum, provide hydrostatic pressure testing on new (and modified) above ground systems piping in accordance with NFPA 13. New system shall be tested to 50 psi over normal system working pressure (minimum 200 psi) for 2 hours without leaks.

C. Provide all required reports, records, and documentation, to the Owner, Engineer, and Authority Having Jurisdiction prior to or at the completion of the project. At a minimum, provide completed and signed "Contractor's Material and Test Certificate for Aboveground Piping" for each system.

3.7 EXTRA STOCK

A. For each style and temperature range required, furnish additional sprinkler heads, amounting to 1 unit for every 100 installed units.

END OF SECTION

SECTION 22 00 00
PLUMBING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including the Conditions of the Contract (General, Supplementary and other Conditions, if any) and all other applicable Divisions, apply to work of this Section.

B. This specification or drawing and the design features or resulting construction disclosed, are the property of Furlow Associates, Inc., and shall not be reproduced without written permission.

C. All fire protection suppression systems shall be part of and included in all of the following Division 22 Sections.

1.2 WORK INCLUDED

A. Provide labor, materials, equipment and supervision necessary to install complete operating Plumbing and Fire Protection Systems as indicated the drawings and specified herein, including all work at the site and within the proposed construction areas to accomplish the required work.

1.3 REGULATIONS, CODES AND STANDARDS

A. Work shall be performed in accordance with latest adopted codes, regulations and ordinances by authorities having jurisdiction. Observe all safety regulations.

B. Latest editions of any referenced standards shall govern.

C. Obtain all municipal and/or the Authorities Having Jurisdiction permits and inspection certificates and pay all charges.

D. Make or arrange for any/or all inspection agency reviews or visits and pay all charges. This includes communication with each respective agency and/or utility to verify the project system work, coordination responsibilities, fees, back charges, etc., required.

E. All fees and back charges shall be verified during the bidding phase of the work. Any discrepancy of this item between any utility, inspection agency and the Contractor shall be brought to the attention of the A/E prior to bid opening.

F. Submission of a bid will be deemed evidence of having complied with these requirements.

1.4 RELATED WORK

A. Refer to equipment shown or specified in all other applicable Divisions that require Plumbing services.

B. Refer to work related to Plumbing as shown on the following contract drawings:

Architectural & Structural

HVAC

Electrical

1.5 COORDINATION

A. The Mechanical, Plumbing and Electrical Contractors are responsible to coordinate all manufacturer's recommended circuit breakers, starters, disconnects and fuse sizes for all equipment. Submission of a shop drawing will certify that this has been completed. Any necessary changes required will be included as part of this contract.

B. Plumbing Contractor shall coordinate scheduling, submittals and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of independent work elements, with provisions to accommodate items that may be installed at a later time.

C. Plumbing Contractor shall verify utility requirements and all characteristics of operating equipment are compatible with the building utilities. Coordinate the work of all sections related and required for installing, connection and placing in service of all equipment.

D. Plumbing Contractor shall coordinate all space requirements, supports and installation of all mechanical, electrical, plumbing and fire protection work, which are indicated diagrammatically on the Drawings. Verify routing of all pipes, ducts, conduits and equipment connections. Maximize accessibility for other work, and service requirements for maintenance and repairs. Develop overall coordination drawing (all trades) and submit for review prior to fabrication/installation.

E. Obtain written confirmation from all related trade Contractors and the Owner or his representative that requirements, conflicts and coordination issues have been discussed and resolved.

F. Coordination of Trades in the Field: The Sheet Metal Contractor shall take precedence and, therefore, shall develop his shop drawings first. These then will be used to overlay the other trades. Next shall be the mechanical piping, plumbing, fire sprinkler and electrical in the order stated. Drawings shall be 3/8" in scale. Initial meeting of contractors shall be convened prior to start of drawings to work out layout, breakdown of building and other details. All drawings shall be completed in CAD with a format compatible and convertible to DWG files. At the end of the effort, each contractor shall provide a full set of shop drawings to each of the other contractors and three sets to the construction manager. Devices requiring access for maintenance shall not be infringed upon by adjacent trades.

1.6 SUBMITTALS

A. Shop Drawings & Product Data:

1. Shop drawings and product data shall be submitted in accordance with Division 22 specifications except where herein modified.

   NOTE: Submittals will only be reviewed once and resubmittals will be reviewed once. Any other submittals will be billed to the Contractor at the Engineer's standard rates.

2. Listed are the required shop drawings and reports required for this project. The Engineer/Owner shall reserve the right to require additional submissions not listed below:
   - All fixtures, equipment and associated devices so listed on the Fixture Schedule on Drawing.
   - Insulation
   - All specified piping systems.
   - All specified valves.
   - Gauges and thermometers
   - Recirculating pump.
   - Hanger and supports including Sumner system.
   - Piping labels and identification.
   - Sump pumps.
   - Testing reports.
   - Sterilization report.
   - Operating/Maintenance manuals.
   - As-Built Drawings.

3. Submittals comprising complete catalog cuts, shop drawings and performance test data for

Plumbing materials and equipment as required by other sections of Division 22, shall be submitted for review checking. The Contractor shall review these for conformance to contract documents prior to submission and affix contractor's signature to each submittal certifying that this review has been done. By approving and submitting shop drawings, product data, samples and similar materials, the Contractor represents that the Contractor has determined and verified materials, field measurements and field construction data that relates to the work, and has checked and coordinated this information with all of the requirements contained in the contract documents for the work of all trades.

4. All submittals shall have the following identification data, as applicable, contained therein or permanently adhered thereto.
   a. Project name.
   b. Project number.
   c. Sub-contractor's, vendor's and/or manufacturer's name and address.
   d. Product identification.
   e. Identification of deviation from contract documents.
   f. Applicable contract drawings and specification section number.
   g. Shop drawing title, drawing number, revision number, and date of drawing and revision.
   h. Resubmit revised or additional submittals as requested.
   i. Wherever shop drawings or vendor's standard data sheets indicate work to be done "by others", it shall be the responsibility of the contractor making the submission to identify by name, the contractor who is to do this work. If the contractor named is other than the contractor making the submission, the shop drawing submission must be reviewed by the named contractor and bear his mark of approval, prior to submission to the Architect/Engineer.
   j. Where equipment proposed differs from that shown on the drawings or specified, he shall submit for approval drawings showing the manner in which the layout is affected by the substitution.
   k. The Contractor shall keep one copy of approved shop drawings at the job site,, filed in a suitable metal container. The shop drawings shall be cataloged and kept in good repair, and shall be available for use by the Owner, Architect and Engineer.
   l. No equipment shall be ordered, fabricated, etc., before approval of shop drawings.

B. Contractor is responsible for the shop drawing coordination and interface with the work of other contracts and adjacent work. The relationship of Contractor’s work shall be verified as it relates to adjacent and critical features of the work of this and all contracts and materials.

1.7 WARRANTY/GUARANTEE

A. All work and materials are subject to the general warranty as described in the General Conditions of the Contract and in all other applicable Divisions. In addition, refer to specifications for special guarantees.

B. Wherever in the specification sections of this division, reference is made to a specific warranty period, this warranty shall be in addition to and not a limitation of other rights the Owner may have against the Contractor under the contract documents.

C. Contractor to include an 11 month “walk-thru” of the building systems with representatives of the School District, Architect, Engineer and the Construction Manager. The purpose is to establish a list of corrective work that relates to operational issues, material/installation deficiencies.

1.8 SITE INSPECTION

A. The Contractor shall visit the site, inspect, and become aware of all conditions which may affect the work during the estimation phase of his work and prior to bid openings. Investigate utilities, protection requirements for adjacent facilities, storage locations, and access to the construction area.

B. Submission of a bid will be deemed evidence of having complied with this requirement.

1.9 SUBSTITUTIONS

A. Whenever a material, article, piece of equipment or system is identified in the following specification or indicated on the drawings by reference to manufacturers' or vendors' names, trade names, catalog numbers or the like, it is so identified for the purpose of establishing the basis of the Bid.

B. Substitution approval must be obtained and included as an addendum item prior to the submission of the bid. An approved substitution shall not be considered as an approval for the Contractor or an equipment vender to deviate from the written portion of the specifications unless so stated in the addendum.

C. The drawings illustrate the space allocated for equipment and the Contractor shall install the equipment accordingly. If changes are required in the building or arrangement due to substitution of equipment, the Contractor making the substitution must pay for the necessary modifications.

D. The listed equivalent or substituted manufacturers along with the bidding related contractor shall be completely responsible to comply with all requirements as indicated on all contract documents and as described within the specifications. This shall include, but shall not be limited to space requirements, code clearances, the type, horsepower, capacities, number and size of services required from other trades, including all required ancillary items furnished and installed by other trades. If the manufacturer or related bidding contractor does not comply with these requirements, then they shall be responsible for any and all additional costs associated with the changes required by other trades.

1.10 LUBRICATION

A. Furnish, install and maintain all required lubrication of any equipment operated prior to acceptance by the Owner. Lubrication shall be as recommended by the equipment manufacturer.

B. Provide one year's supply of lubricants to Owner at date of acceptance.

C. Verify that required lubrication has taken place prior to any equipment start-up.

1.11 EQUIPMENT START-UP

A. Verify proper installation by manufacturer or his representative.

B. Advise General Contractor 2 days prior to actual start-up.

C. Verify proper operation. Obtain signed statement by manufacturer or his representative that equipment is operating within warranty requirements. Submit statement to General Contractor.

1.12 OPERATION & MAINTENANCE INSTRUCTIONS

A. Properly and fully instruct Owner's personnel in the operation and maintenance of all systems and equipment.

B. Insure that the Owner's personnel are familiar with all operations to carry on required activities.

C. Such instruction shall be for each item of equipment and each system as a whole.

D. Provide report that instruction has taken place. Include in the report the equipment and/or systems instructed, date, contractor, Owner's personnel, vendor, and that a complete operating and maintenance manual has been reviewed.

E. Manual shall include all instructions on operation, maintenance, repair parts list, lubrication requirements, brochures, catalogue cuts, wiring diagrams, piping diagrams, control sequences, service

requirements, names and addresses of vendors, suppliers and emergency contacts. Three manuals shall be provided.

F. Submit manuals for review prior to operating instruction period. Manuals shall be 8-1/2 x 11" with hard cover, suitably bound.

G. Provide to the Owner any special tools necessary for operation and routine maintenance of any of the equipment.

H. Furnish three (3) copies of a professionally taped video and three (3) copies of professionally prepared drawings demonstrating the following:

- Location of main shut-off valves
- Procedures for equipment start-up and seasonal shut-downs.
- Procedures for maintenance.
- Provide written version of all procedures included in video.

The above should cover all equipment/systems including, but not limited to the following:

- Hot water heater and pumps
- Flush valves
- Water coolers
- Sump pumps
- Mixing valve

1.13 TOOLS

A. All equipment furnished by the Contractor which requires special tools or devices other than those normally available to the maintenance or operating staff shall be furnished in duplicate to the Owner, sufficiently marked, packed or boxed for staff usage. The tools provided shall be listed by the Contractor identified as to their use or the equipment applicable in a written transmittal to the Owner.

1.14 CLEANING AND FINISHING

A. After equipment start-up and all operating tests have been made and the system pronounced satisfactory, each respective Contractor shall go over the entire project, clean all equipment, etc., installed by him and leave in a clean and working condition. Any surfaces found marred after this final cleaning shall be refinished or replaced by each Contractor at no cost to the Owner.

B. Provide for the safety and good condition of all materials and equipment until final acceptance by the Owner. Protect all materials and equipment from damage. Provide adequate and proper storage facilities during the progress of the work. Special care shall be taken to provide protection for bearings, open connections, pipe coils, pumps, compressors and similar equipment.

C. All NEW fixtures, piping, finished surfaces and equipment installed shall have all grease, adhesive labels and foreign materials removed.

D. All new piping installed shall be drained and flushed to remove grease and foreign matter. Pressure regulating assemblies, traps, flush valves and similar items shall be thoroughly cleaned. Remove and thoroughly clean and reinstall all liquid strainer screens after the system has been in operation ten (10) days.

E. Gas piping shall be blown out with clean compressed air or inert gas.

F. When connections are made to existing systems, the Contractor shall do all cleaning and purging of the existing systems required to restore them to the condition existing prior to the start of work.

G. Clean-up: Remove from the premises, all unused material and debris resulting from the performance of work under this section.

PART 2 – PRODUCTS

2.1 GENERAL

A. All material and equipment shall be new and of present day manufacture, and shall conform to accepted standards of the trade where such a standard has been established for the particular type of equipment or material.

B. Whenever equipment or material is referred to in the singular, such as "the plumbing fixture", it shall be deemed to apply to as many such items as necessary to complete the work.

2.2 PRODUCT DELIVERY, STORAGE AND HANDLING

A. During loading, transporting and unloading exercise care to prevent damage to material.

B. Store all materials in dry enclosures or under protective coverings out of way of work progress.

C. Material shall not be allowed to be stored directly on ground.

D. Deliver in manufacturer's original cartons or on skids.

E. Handle and protect so as to prevent damage to product or any surrounding material.

2.3 CONCRETE

A. Concrete if used on this project, shall be in accordance with Division 03 Concrete.

B. The 28-day minimum compressive strength shall be 3000 psi.

PART 3 – EXECUTION

3.1 PROTECTION

A. Plug or cap open ends of piping systems.

B. Stored materials shall be covered to prevent damage by inclement weather, sun, dust or moisture.

C. Protect all installed work until accepted in place by the Owner.

D. Plates, polished metal escutcheons and other finished devices shall not be installed until masonry, tile, and painting operations are complete unless otherwise protected.

E. Protect all work from operations which may cause damage such as hauling, welding, soldering, painting, insulating and covering.

F. Do not remove protective material until equipment is placed in service.

3.2 WORKMANSHIP

A. Install all work neat, trim and plumb with building lines.

B. Install work in spaces allocated.

C. Cutting and patching shall be performed by skilled tradesmen normally employed for the work involved.

3.3 EXCAVATION

A. The excavation shall be of the open-trench method and to the depths and widths as may be necessary. The Contractor shall do all excavation required in connection with his work. Bottoms of trenches shall be excavated to a uniform grade. All materials excavated shall be deposited on the side of the trenches and beyond the reach of the slides. Excavated material shall not be piled where it will interfere with traffic. If rock is encountered, it shall be removed by the General Contractor. See provisions in Division 2.

B. No piping shall be bedded directly on rock. They shall be cushioned by a 6-inch layer of crushed stone or gravel of selected grade, of size to pass through 3/4" mesh sieve. Not less than 30% shall be fine which will pass through a 3/8" mesh sieve.

3.4 SHORING AND PUMPING

A. The Contractor shall provide all shoring, bracing or sheet piling necessary to maintain the banks of his excavation and shall take out same as the work progresses and filling in has been accomplished. Shoring shall be in accordance with OSHA Standards.

B. The arrangement of shoring must be such as to prevent any movement of the trench banks and consequent strains on the conduits. Shoring shall be provided to prevent damage to work installed by other trades.

C. The Contractor shall do all pumping required to keep his excavations free of water. The water shall be conveyed in piping or watertight troughs a sufficient distance that it will flow from the site and not affect other work being performed.

3.5 BACKFILLING

A. After work in trenches has been completed, they shall be filled with select fill in 8" layers and shall be pneumatically tamped before the next layer of material has been filled in. The backfill shall be free of excavated rock, cinders, stones, brickbats or other debris.

B. Wherever rock is removed, the Contractor shall secure and fill select clean earth to a minimum depth of 3'-0" above the top of the pipe. Unless otherwise indicated, no rock shall be deposited in the trench fill. This clean earth fill shall be procured other than from the site unless permission for earth borrow from the site is granted by the Architect. If site borrow is permitted, the topsoil removal, relocation and finished grading will be accomplished as directed by the Architect.

C. Under no circumstances shall excavated material be left where it will interfere with the Owner's or other Contractor's operations.

D. All earth and other materials taken from the trenches and not required for backfilling shall be deposited where directed, or removed from the premises as directed by the Architect.

E. Any rock removed from the excavation shall be removed from the project site by the Contractor.

F. Trenches which pass under wall footings or within 18" of column footings shall be backfilled with lean concrete. To secure adequate foundation support, the method and depositing of the concrete fill shall be as directed by the Architect. To prevent the concrete from adhering to the pipes, necessary pipe protection shall be applied.

3.6 EQUIPMENT SETTING

A. Furnish and install as a minimum, a 4-inch concrete pad beneath all floor-mounted equipment. Install anchor bolts in pour.

B. Furnish and install as a minimum, spring vibration isolation under any equipment 10 HP and over and rubber in shear vibration isolation on any equipment up to 10 HP.

C. Concrete shall be 3,000 psi, 28-day compressive strength in accordance with ACI-613. Reinforce with No. 4 rod 12" on centers both ways or as otherwise detailed.

3.7 FASTENERS, HANGERS AND SUPPORTS

A. Furnish and install all hangers and supports required to suspend, mount, or hang the work.

B. Furnish and install all miscellaneous steel angles, channels, beams, clips, brackets and anchors necessary to hang or support the work. Provide submissions for review.

C. Install concrete inserts before concrete is poured.

D. Drilled inserts shall not be loaded more than 1/4 rated capacity or 200 pounds.

E. Power-driven fasteners shall not be allowed for piping larger than 2 inch, or equipment. When used they shall not be loaded more than 1/8 rated capacity or 200 pounds.

F. All hangers, miscellaneous steel, braces and supports shall be galvanized, cadmium plated, or primed steel. Copper tubing shall be supported with copper hangers. No direct contact of dissimilar metals between the piping system and its hanger support shall be permitted.

G. Piping shall be supported from adjustable clevis type hangers with insulation pipe saddles. Where hangers are 18” or longer, provide lateral bracing at every fourth hanger. See IPC Pipe Support Table below:

PIPE SUPPORT SPACING

Material	Horizontal Max. Feet	Vertical Max. Feet
ABS Pipe	4	10
Aluminum	10	15
Brass	10	10
Brass Tube up to 1-1/4”	6	10
Brass Tube over 1-1/2”	10	10
Cast Iron	5	15
Copper up to 1-1/4”	6	10
Copper over 1-1/4”	10	10
CPVC Up to 1”	3	10
CPVC Over 1”	4	10
Lead Pipe	Continuous	4
PB Pipe/Tubing	2.6 ft. (32”)	10
PVC Pipe	4	10
PEX	2.6 ft. (32”)	10
Steel Tubing	8	10
Steel Pipe	12	15

H. Support vertical piping at floor levels using approved riser clamps. Clamp material shall be compatible with pipe material. Maximum vertical spacing shall be10’-0”.

3.8 SLEEVES

A. Provide each pipe passing through a masonry or concrete wall, floor or partition with a sleeve made from standard weight steel pipe for pipe with smooth edges, securely and neatly cemented in place. Provide each pipe passing through a frame or metal partition with a sleeve made from No. 22 gauge galvanized sheet metal, securely fastened in place.

B. Pipe passing through foundation wall or under foundation shall be provided with relieving arch or steel pipe per IPC Section 305.5.

C. Be responsible for the proper location and alignment of all sleeves.

D. Provide hydrostatic seals for sleeves passing through outside walls, below grade, or through hydrostatically sealed slabs or floors on grade. Provide fire-rated seals for all other sleeves.

E. Install both piping and sleeve seals so as to maintain integrity of seals with expansion and contraction of piping.

F. Set floor sleeves flush with floor surface in finished areas, 1" above the finished floor in kitchens, cafeterias, and similar service areas unless such areas are slab-on-grade; 1" above the floor in

mechanical rooms, pipe chases, pipe spaces and other unfinished areas, unless otherwise indicated, and flush with the underside of slabs. Extend wall and partition sleeves through and cut flush with each surface unless otherwise indicated or specified.

G. Select sleeves two pipe sizes larger than any pipe that is to remain uncovered, unless otherwise required by the sealing method specified. Where pipes are to be covered, provide sleeves large enough to allow the covering to pass through the sleeves with sufficient clearance for sealing as specified hereinafter. Size sleeves for branch piping from vertical risers large enough to permit vertical expansion at the riser.

H. Place sleeves imbedded in concrete floors or walls in the forms before concrete is poured; sleeves shall have integral waterstop flanges, where they are to receive either watertight or hydrostatic seals.

I. Install sleeves passing through above-grade floors of mechanical rooms, toilet rooms, kitchens or similar service areas where liquid leaks or spillover may occur in a watertight manner. Sleeves shall be such that waterproofing membrane can be flashed around and into the sleeve where necessary.

J. Seal sleeves for pipes passing through ceiling air plenum walls or the floor above air tight in a manner similar to that specified for fire-rated sleeves.

K. Hydrostatic Sealing Method: Provide compressible synthetic rubber seals, equivalent to LINK SEAL, manufactured by the Thunderline Corporation, or THRUWALL manufactured by O.Z. Gedney. Install seals in accordance with the manufacturer's recommendations to provide air tightness aboveground and hydrostatic sealing belowgrade. Caulking or other type mastic is not acceptable.

L. Fire-Rated Sealing Method:

1. Sleeves, openings and sealants shall comply with applicable codes, recommended practices and standards, and manufacturer's instructions. Fire sealants shall have ability to prevent spread of flame, smoke or water throughout the penetration and shall pass 3 hour test, UL test ASTM E814 and UL 1479.
2. Products: Chase Corporation CTC PR-855, O. Z. Gedney CRS/CAFS, 3M Electro-Products Division Putty 303 or Caulk CP25 penetration sealing kits, General Electric Company sealants type RTV-850, 6428 or 7403, Thunderline Corporation "Link-Seal Pyro-Pak". Installation and type of sealant to be used as recommended by the manufacturer.
3. Expansion collars, fire seal/firestop collars – ASTM E814 (UL1479). Spec Seal Corporation, Inc. (plastic pipe).

3.9 PLATES

A. Furnish and install chrome plated plates wherever piping passes into finished area.

B. Plates shall be securely fastened to piping or building construction.

C. Floor plates shall cover 1-inch sleeve extension.

3.10 OFFSETS, TRANSITIONS, MODIFICATIONS

A. Furnish and install all offsets necessary to install the work and to provide clearance for other trades.

B. Maintain adequate headroom and clearance.

C. Incidental modifications necessary to the installation of the systems shall be made as necessary and as approved by the Architect.

3.11 RECESSES

A. Furnish information to the General Contractor as to sizes and locations of recesses required to install panels, boxes, and other equipment or devices which are to be recessed in walls.

B. Make offsets or modifications as required to suit final locations.

3.12 LABELING

A. All Plumbing equipment such as pumps, and devices requiring identification for operating procedures shall be provided with permanent black laminated micarta white core labels with 3/8-inch letters.

B. This shall also apply to all controllers, remote start/stop pushbuttons and equipment cabinets.

3.13 FLASHING AND COUNTERFLASHING

A. Roof drains, vents, roof curbs, etc., shall have counterflashing fittings. General Contractor shall provide flashing.

B. Piping and conduit thru the roof shall be flashed by the General Contractor. Furnish and install counterflashing.

3.14 ACCESS

A. Locate all equipment, valves, devices and controllers which may need service in accessible places.

B. Where access is not available, access panels shall be provided. Furnish access doors to the General Contractor for installation.

C. Access doors shall be Elmdor, Karp Co., MIFAB or Controlled Air Manufacturing Limited, with 16-gauge frames and 14-gauge steel door, prime painted.

D. Maintain required access clearances.

3.15 WIRING

A. Packaged plumbing system equipment shall be furnished with disconnect switches, and magnetic starters, factory furnished and wired by the unit manufacturer.

B. All control wiring shall be furnished and installed under this Division of the work.

C. All wiring shall be in accordance with the National Electrical Code and as recommended by the equipment manufacturer.

3.16 UTILITIES

A. Do not interrupt any utility or service to the Owner without adequate previous notice and schedule.

B. Arrange and pay for the relocation, disconnection or removal of, or relocate, disconnect or remove existing utilities and services where such work is shown or where such utilities or services interfere with new construction, whether or not shown. Provide all excavation, backfilling and paving required by such work.

C. Perform alteration of utilities and services in accordance with the rules, regulations and requirements of the involved utility companies, regulatory agencies having jurisdiction.

3.17 CUTTING AND PATCHING EXTERIOR SURFACES

A. This Contractor shall be responsible for returning disturbed paved and/or grass areas to original condition where excavation for utilities has been required.

B. Cut and patch paved areas to match original surface.

C. Properly tamp backfill before finishing or repairing disturbed area surfaces.

3.18 OPENINGS - CUTTING, REPAIRING

A. This contractor shall cooperate with the work to be done under other sections in providing information as to openings required in walls, slabs and footings for all piping and equipment, including sleeves where required.

B. Any drilling or cutting required for the performance of work under this Section, shall be the responsibility of this Contractor and the cost thereof shall be borne by him.

C. Holes in Concrete: Sleeves shall be furnished, accurately located and installed in forms before

pouring of concrete. This contractor shall pay all additional costs for cutting of holes as the result of the incorrect location of sleeves. All holes through existing concrete shall be either core drill or saw cut. All holes required shall have the approval of the Structural Engineer prior to cutting or drilling.

D. It shall be the responsibility of this Contractor to ascertain that all chases and openings are properly located.

3.19 GUARANTEE

A. All materials and equipment provided and/or installed under this section of the specifications shall be guaranteed for a period of one year from the date of acceptance of the work by the Owner unless otherwise specified in other applicable Divisions. Should any trouble develop during this period due to defective materials or faulty workmanship, the Contractor shall furnish all necessary labor and materials to correct the trouble without any cost to the Owner. Any defective materials or inferior workmanship noticed at time of installation and/or during the guarantee period shall be corrected immediately to the entire satisfaction of the Owner.

In the event of occupancy by the Owner prior to final acceptance of the project, the guarantee date for equipment placed in operation shall be mutually agreed to by the Contractor and the Owner's representative.

B. Contractor to include an 11 month “walk-thru” of the building system with representatives of the School District, Architect, Engineer and the Construction Manager. The purpose is to establish a list of corrective work that relates to operational issues, material/installation deficiencies.

3.20 DRAWINGS

A. The Plumbing Systems are indicated on the Contract Drawings. Certain pertinent information and details required by the Plumbing Work appear on the Architectural, Structural and Electrical Drawings; become familiar with all Drawings; and incorporate all pertinent requirements.

B. Drawings are diagrammatic and indicate the general arrangement of systems and requirements of the Work. Do not scale Drawings. Exact locations of fixtures and equipment, not specifically shown shall be obtained before starting work.

C. When indicated on the drawings, plumbing riser diagrams are completely diagrammatic and indicate the intent of the work for both the Contractor, L&I review agencies and/or Authorities Having Jurisdiction. Where valves, shock absorbers, incidental equipment, devices, etc., including execution notes are indicated on the riser diagrams, they shall be so required and installed as part of the system work.

3.21 RECORD DRAWINGS

A. As-Built record drawings, showing dimensions, locations and depth of all buried and concealed piping, plugged outlets and equipment shall be kept up to date. Master copy shall be kept on the job. No backfilling of trenches shall be permitted until as-built drawings are approved as up-to-date by the Owner/Representative. No plumbing progress payments shall be approved unless as-built drawings are up- to-date. Depth of sewers shall be from a permanent bench mark as shown on the contract drawings. Refer to project record drawings under General Conditions.

END OF SECTION

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SECTION 22 05 00
COMMON WORK RESULTS FOR PLUMBING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including the Conditions of the Contract (General, Supplementary and other Conditions, if any) and Division 1 as appropriate, apply to the work specified in this Section.

1.2 REFERENCE

A. Install all piping, fixtures, equipment, etc., to meet the requirements of the following:

New Castle County Department of License and Inspection

New Castle County Department of Sewers

State of Delaware Plumbing Code

International Plumbing Code

Delaware State Fire Marshal's Office

International Plumbing Code (All applicable sections)

International Mechanical Code (All applicable sections)

International Fuel Gas Code (All applicable sections)

Gas Utility Company

Water Company

NFPA

OSHA

All requirements of the above governing agencies shall be in compliance with the latest issues, rules or regulations in effect.

B. Appliances and materials governed by UL requirements shall meet such requirements and bear the label.

1.3 QUALITY ASSURANCE

A. Provide adequate supervision of labor force to assure all aspects of specifications are being fulfilled.

B. Insure that all work and equipment is installed in accordance with manufacturer's warranty requirements.

C. Replace all pipes and fittings shown to be defective as a result of testing.

1.4 SUBMITTALS

A. Submit shop drawings and product data in accordance with Section 22 00 00.

B. Submit the following:

1. Manufacturer's Product Data on all pipe and fittings to be used in project.
2. Manufacturer's Product Data on all valves to be used in project.

1.5 WARRANTY/GUARANTEE

A. All work and materials are subject to the general warranty as described in the General Conditions of the Contract and in Division 1, GENERAL REQUIREMENTS.

PART 2 – PRODUCTS

2.1 STEEL PIPE & FITTINGS

A. Pipe: ASTM A-53, Schedule 40.

B. Fittings:

1. Cast iron, threaded, 175 psi, ANSI B-16.4.
2. Malleable iron, threaded, ASA B 16.3.
3. Steel, socket weld, ASTM A-53.
4. Wrought iron, socket weld, ASTM A-72.

C. Thread tape shall be teflon tape, 3 mils minimum thickness. Teflon tape shall not be permitted for use on gas piping systems.

D. See Section 23 10 00 Facility Fuel Systems.

2.2 CAST IRON PIPE AND FITTINGS

(Note: Any cast iron piping made or marked “CHINA” will NOT be acceptable on this project)

A. Aboveground:

1. Pipe & Fittings: Hubless cast iron, CISPI 301, ASTM A-74 and ASTM A-888 shall be marked with the collective trademark of the Cast Iron Institute (soil pipe).
2. Joints: Neoprene sleeve and stainless-steel shield and clamp assembly, CISPI 310, ASTM-1277.

B. Below grade and/or slab: (Contractor's Option)

1. Bell and Spigot: Service weight bell and spigot pattern ASTM-74 with compression type neoprene gaskets ASTM C-564.
2. Hubless: Hubless cast iron pipe CISPI 301, with heavy duty 3.04.016 stainless steel bands for below-grade installation. Elastomeric seal component ASTM C-564 and CSA B-602.
3. Hubless Joints: Cast iron CISPI 310 and as TM C-1277.
4. PVC DWV pipe and fittings, Schedule 40, ASTM D-2665, D2949, F891 and CSA B181.2.
5. Corrosion protection shall be in accordance with IPC 305.1. Provide appropriate wrapping or sheathing when pipe is exposed to lime and acid of concrete, cinder or other corrosive materials.
6. Protection of all below-grade storm and sanitary shall be in accordance with IPC Section 305.
7. All Kitchen and Boiler Room below slab piping shall be service weight cast iron only. PVC not allowed.

C. Corrosion protection shall be in accordance with IPC 305.1. Provide appropriate wrapping or sheathing when piping is exposed to lime and acid of concrete, cinder or other corrosive materials.

2.3 COPPER TUBING

A. Domestic hot, cold and recirculated water:

1. Aboveground:
   a. Tubing: Hard-drawn, seamless ASTM B-88, Type "L".
   b. Fittings: Solder joint wrought copper ANSI B-16.22.
   c. Joints: Lead-free solder 410°, ASTM B-32 alloy designation “TC”, ASTM B-828.
   d. Flux: Non-toxic and non-corrosive, ASTM B-813.

2. Underground:
   a. Tubing: Soft-drawn, seamless ASTM B-88, Type "K".
   b. Fittings: Solder joint wrought copper ANSI B-16.22.
   c. Joints: Lead-free solder 410°, ASTM B-32, ASTM B-828.
   d. Flux: Non-toxic and non-corrosive, ASTM B-813.

B. Drainage and vent piping:
1. Aboveground:
   a. Tubing: Hard-drawn seamless ASTM B-88, ASTM B-75, Type "M" and DWV as pipe size permits.
   b. Fittings: Solder joint cast copper drainage type ANSI B-16.29.
   c. Joints: Soldered, 95/5 tin-antimony ASTM B-828, ASTM B-32.
   d. Flux: Non-toxic and non-corrosive, ASTM B-813.

C. Solder/Flux: See Paragraph 3.4 of this section for Soldering/Brazing.

2.4 DUCTILE IRON PIPE

A. Pipe: Ductile iron, ANSI A-21.51, ANSI/AWWA C151.

B. Joints: Rubber gasket, ANSI A-21.11, ANSI/AWWA C111.

C. Fittings: Mechanical joint, ANSI/AWWA C110, C153 bolt tolerances – AWWA C-111, ASTM A-563.

D. Lining: Cement mortar, ANSI A-21.4, ANSI/AWWA C104.

2.5 PVC GRAVITY SEWER PIPE

A. Pipe: Unplasticized polyvinyl chloride (PVC) with integral wall bell and spigot joints.

B. Material: ASTM D-3034 for SDR 35, colored green for inground identification as sewer pipe.

C. Joints: Two sections of pipe shall be assembled in accordance with manufacturer's recommendations and tested as per ASTM D 3212 for use with flexible elastomeric seals.

D. Sizes: For site drainage systems 4" to 15".

E. Additional compliances:
1. Drop Impact Test - ASTM D-2444
2. Pipe Stiffness - ASTM D-2412
3. Temperature for Testing - Designed to pass all tests at 73 degrees F (+/- 3 degrees F).

2.6 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

A. Underground – Drainage & Vent (Sanitary) IPC Table 702.2
1. ASTM D 2665
2. ASTM D 2949
3. ASTM F 891
4. CSA CAN/CSA-B 181.2

B. Building Sewer Pipe (Near Water Service) IPC Table 702.3 (DWV)
1. ASTM D 2665
2. ASTM D 2949
3. ASTM D 3034

4. ASTM F 891
5. CSA B182.2
6. CSA B 182.4 (Ribbed Sewer Pipe & Fittings)

C. Fittings:
1. ASTM D 3311
2. ASTM D-2665
3. ASTM F-1866

D. Solvent Cement: (All Purpose on ABS, PVC and CPVC)

Potable Water, Sewer, Drain Waste and Vent
1. ASTM D-2564, D-2235 and F-493
2. CSA B137.3
3. CSA B181.2 or B182.1 (Sanitary Pipe only)
4. ASTM D2855
5. CSA B181.1

E. Uniformity: To insure installation uniformity, all piping components shall be of one manufacturer.

2.7 CORRUGATED METAL PIPE

A. Pipe:
1. 24" diameter and smaller shall be 16 U.S. gauge steel.
2. 30" diameter and larger shall be 14 U.S. gauge steel.
3. All piping shall be completely bituminous coated on the interior and exterior and shall have a paved invert for 25% of its periphery.

B. Joints: Standard coupling bands and bolts as furnished by the pipe manufacturer.

2.8 VALVES (Copper Systems) – Solder ends of Threaded

A. Valves listed below shall be for domestic water systems and comply with the latest requirements of NSF 61-8. Refer to individual sections for gas valves.

B. Ball Valves: NIBCO two-piece, full port, 600 psi WOG rated, cold non-shock valve with reinforced TFE seals, 316 stainless steel ball, Eco-brass body, ASTM 584, Alloy C87850, solder ends, or threaded non-blowout stem design. Acceptable NIBCO figure numbers: T/S 685-80-66-LF; T/S 595-Y-66-LF (3 piece).

C. Check Valves: NIBCO Class 125, Eco-brass body, ASTM 584, Alloy C87850, swing type, Y Pattern, threaded cap access. Acceptable NIBCO figure number: T/S 413-LF.

D. Gate Valves: NIBCO Class 125, Eco-Brass body, ASTM 584, Alloy C87850, Rising Stem. Acceptable NIBCO figure number: T/S 113-LF.

E. Balance Valves: All balance valves shall be provided with a memory stop feature with calibrated name plate to assure specific valve setting. Bronze body/brass ball, carbon filled TFE seat rings. NIBCO, Bell & Gosset, Accu-Flow, Taco or Flow Design "Accusetter". Acceptable NIBCO figure numbers: T/S 1710, F/G 737.

F. Strainers:
1. Class 125 Bronze Y-Strainer, body to be ASTM B584 or B62 bronze with threaded, solder or female press end connections and .033-inch perforated type 304 stainless steel screen or 20 mesh type 304 stainless steel screen accessible without removing the strainer from the line. Acceptable

Figure numbers: NIBCO Fig. S/T-221, S/T-222, PF-221/222-A,B.

2. Class 125 Flanged Cast Iron Y-Strainer, body to be ASTM A-126 Class B cast iron. End connections to be Class 125 flanged, tapped bolted bonnet with plug. Screen shall be .033-inch perforated type 304 stainless steel screen or 20 mesh type 304 stainless steel screen accessible without removing the strainer from the line. Acceptable Figure numbers: NIBCO Fig. F 721-A.
3. Class 250 Threaded Cast Iron Y-Strainer: Strainer body to be ASTM A-126 Class B cast iron. End connections to be Class 250 threaded, tapped screw-in bonnet with plug. Screen shall be .033-inch perforated type 304 stainless steel screen or 20 mesh type 304 stainless steel screen accessible without removing the strainer from the line. Acceptable Figure numbers: NIBCO Fig. T-751-A

G. VALVES (Copper Systems) – Press Fit

1. Valves listed below shall be for domestic water systems and comply with the latest requirements of NSF-61-8.
   a. 2 Inch and Smaller Ball Valves (On/Off):

      Ball Valves with male or female press to connect shall be rated at 200 PSI CWP to +225°F maximum. Valves shall be manufactured in accordance with MSS SP-110 and constructed of dezincification resistant cast bronze bodies. Brass with more than 15% zinc shall not be approved. Valve shall have reinforced PTFE Seats, Blow-out Proof Stem, Full Port Ball, Chrome/Nickel Plated or Stainless-Steel Ball for aggressive water.

   b. 2 Inch and Smaller Check Valves (Swing Type):

      Check valves shall be swing type Y pattern with male or female press to connect ends and shall be rated 200 PSI CWP to + 250°F maximum. Valves shall be manufactured in accordance with MSS SP-80. Body & cap shall be manufactured of dezincification resistant cast bronze ASTM B62 or ASTM B584 Alloy C8440. Valves shall have PTFE seat disc.

   c. 2 Inch and Smaller Check Valves (Lift or Spring Type):

      Incline resilient disc, spring actuated, 250psi rating, non-shock cold working pressure, 2500F maximum working temperature, bronze ASTM B584 alloy C84400. Stainless steel stem and disc holder and spring, EDPM O-ring.

H. Insofar as possible, all valves of the same type shall be of the same manufacturer.

I. Valve Manufacturers: Subject to compliance with requirements, provide valves of one of the following:

   Apollo/Conbraco

   Stockham

   Nibco

   Milwaukee

   Watts

   Hammond

   Webstone

J. System Application:

1. Domestic Water:
   a. Check Valves - 2" & Smaller - threaded or soldered.
   b. Ball Valves - 3" & Smaller - threaded or soldered.
   c. Balance Valves - All sizes - threaded.

d. Butterfly Valves - 4" and larger - flanged.

e. Butterfly Valves – 3” and smaller – wafer type.

2.9 THERMOMETERS

A. Separable socket, inserted into fluid flow, adjustable, hermetically sealed, red mercury, die-cast, baked enamel finish, double strength glass lens, white scale and black graduations.

B. Scale: Select range of thermometer to indicate normal operating temperature at mid-point of scale for domestic water systems.

C. Manufacturer: U.S. Gauge, H.O. Trerice, Moeller, Duro.

2.10 GAUGES

A. Phosphor bronze bourdon tube, polypropylene case, gasketed glass crystal, aluminum dial, black graduations 4-1/2-inch diameter.

B. Range: 0 to 150 psi, 5-pound intervals, 1/2-pound graduations.

C. Manufacturers: Danton, U.S. Gauge, H.O. Trerice, Moeller.

D. Install with bronze gauge cock.

2.11 ISOLATING FITTINGS

A. Furnish isolating fittings between all sections of dissimilar piping materials or piping, general supports, equipment and supports, including piping hanger and rack supports where one material is ferrous and the other is non-ferrous.

B. Install copper or brass piping or tubing in such a way as not to touch or come in contact with ferrous metals.

C. Where ferrous piping or equipment is connected to copper or brass piping, make connection with insulating or dielectric unions to prevent electrolytic action between the ferrous and non-ferrous metals.

D. Where copper or brass piping, tubing or fittings are anchored to, supported by or may come in contact with ferrous metal construction, provide an insulating nonconductor spacer of rubber, fiber or equivalent material to assure prevention of electrolysis.

E. Manufacturer: Epco Sales, Inc., or insulated unions by Central Plastic Co.

2.12 ANCHORS AND GUIDES

A. Anchors and guides shall be provided to support and maintain pipes in position and properly distribute expansion. The anchors and guides must be securely fastened to the building structure, and must be completely installed before the system is tested.

B. Guides shall be as manufactured by J.J. McNally, Inc., Flexonics, Inc., Tube-Turns, American District Steam Co.

2.13 UNIONS

A. Up to and including 2-inch pipe size: Screwed pattern, bronze-to- bronze seat.

B. Above 2-inch pipe size: 125 Class Flanged pattern, A.S.A. sweat copper fitting, with gaskets, bolts and nuts.

C. Copper tubing unions shall have sweated type ends. Flanged unions on copper tubing may be soldered connections.

D. Materials and pressure ratings shall be the same as specified for the respective pipe and fitting system unless otherwise specified.

PART 3 – EXECUTION

3.1 PIPING SYSTEM INSTALLATION REQUIREMENTS

A. Drawings are generally diagrammatic and due to small scale, it is impossible to indicate all fittings, valves, gauges and specialties required. Provide complete operating systems and all necessary fittings, valves gauges and specialties whether or not indicated.

B. Install all piping in accordance with the best practices of the trade and latest code requirements. Use uniform system materials throughout the building. All branch take-offs shall be off the top of the pipe.

C. Pipe and fittings shall be clean from cutting burrs, foreign materials and defects in structure and threading. Make all cuts square. Ream after cutting. Clean off scale and dirt inside and outside, before assembly. Remove welding slag or other foreign material.

D. Keep all piping as high as possible, consistent with proper pitch, to maintain maximum headroom. Cut piping accurately to measurements established at the building, work into place without springing, forcing or cutting of the building structure, and install as directly as possible between connecting points parallel with or at right angles to building construction, except as required to obtain pitch.

E. Unless otherwise shown, run piping within the building, concealed in the walls, furred spaces, pipe spaces or above suspended ceilings. Unless otherwise noted, do not build in or bury horizontal piping in partitions. Install all exposed piping as closely as possible to walls, ceilings and columns, consistent with access and applicable insulation requirements.

F. All piping to drain to low points. Low points will be provided with drain valves with hose thread. All piping shall have high points vented with ball valve, nipple and threaded cap.

G. Do not install trapped lines where water cannot be drained or air can accumulate without being vented.

H. Piping shall run square with building lines.

I. Piping shall not be insulated or covered until tested and until building is closed in.

J. Necessary drains, off-sets, vents and drips shall be provided for coordination of the work as part of the contract.

K. Piping shall not be installed over electrical transformers, panels, switchgear, substations, and control panels as per the National Electric Code. No piping shall be installed in elevator machine rooms unless it is directly related to the room's system equipment.

L. Allow clearance for expansion and contraction.

M. Install isolating fittings between sections of ferrous and non- ferrous pipe or connected equipment.

N. Valves shall be installed with stems above horizontal.

O. Valves shall be installed on all sides of equipment and control valves to allow isolation for repair.

P. Do not support piping from other piping, conduits or equipment. Provide additional bracing to prevent movement of trapeze piping, or any singular run of pipe to fixtures. Provide additional bracing on all piping through walls to flush valves to prevent movement during normal operation or performing maintenance on valves.

Q. Thermometers and gauges shall be installed where indicated on the drawings, required by equipment specifications and where indicated elsewhere in the specifications. Gauges shall be located at an elevation that can be readable.

R. Unions shall be provided adjacent to all valves, at equipment connections, and where necessary to facilitate dismantling of the piping system.

S. Ball valves to be installed with the proper clearance for operating the valve handle. A minimum clearance of 10" from center of valve to wall must be maintained for ease of operation.

T. Thermometers are to be located so they can easily be seen from the floor in front of unit. Make final adjustment by tilting thermometer. Locate bulb in waterway with an oversized tee or elbow fitting.

U. Install pressure gauges on incoming services both domestic water and fire services. Locate pressure gauge after main shut-off valve and ahead of water meter if one is provided within building.

V. All pipe unions installed shall be accessible. Unions shall not be concealed or located in places where they cannot be maintained.

W. Support and bracing of 4” and above pipe shall be in accordance with the CISPI Standards and IPC Chapter 3.

3.2 TAGS, CHARTS, AND IDENTIFICATION

A. All piping shall be labeled in accordance with IPC 303.1 and 303.4.

B. Identify each valve in all systems with black, numbered and stamped 1-1/2" brass or aluminum tags fastened to valve by brass chain and S-hook.

C. Piping Identification: Provide identification and safety products, semi-rigid plastic, wraparound pipe markers with flow arrows and conforming to ANSI A13.1. Locate marker at each valve, changes in direction, where pipes pass thru barriers and every 25' of horizontal runs. Lettering on background shall be in accordance with the following colors:

Legend	Background	Lettering
1. Gas	- Yellow	- Black
2. Fire Protection	- Red	- White
3. Domestic Cold Water	- Green	- White
4. Domestic Hot Water (110° ^ 140°)	- Yellow	- Black
5. Domestic Hot Water Return (110° ^ 140°)	- Yellow	- Black
6. Sanitary Drainage	- Green	- White
7. Condensate Drainage	- Yellow	- Black
8. Vent	- Yellow	- Black
9. Storm Drainage	- Green	- White
10. Medical Gas	Conform to NFPA-99 Regulations	
11. Plant Compressed Air	- Yellow	- Black

D. Provide 1/8" scale diagrams showing location, number and service or function of each tagged item.

1. Frame diagrams in approved metal frames with clear acrylic front, hinges, and locks.
2. Secure to wall in Mechanical Room.
3. Provide two additional separate copies permanently covered and bound.

E. Furnish and install color coded 1” diameter markers on ceiling tile grids to indicate system and valve locations.

1. Domestic cold water: - Green
2. Domestic hot water: - Yellow
3. Domestic hot water return: - Yellow
4. Gas - Yellow

F. Available Manufacturers: Subject to compliance with requirements, manufacturer's offering identification markers which may be incorporated in the work are limited to the following:

Seton

Brimar

B-Line

Marking Services, Inc.

3.3 WELDING

A. All concealed and inaccessible black steel piping shall be welded.

B. All black steel piping larger than 2 inch shall be fusion welded.

C. All elbows, tees and branch connections shall be made with welding fittings ANSI B16.9.

D. Welding shall be in accordance with the ASME Boiler and Pressure Vessel Code Section IX.

E. Furnish welder test certificate for review. Certificates of successful qualification by the following organizations shall be acceptable.

1. ASME Boiler and Pressure Vessel Code
2. ANSI Code for Pressure Piping
3. National Certified Pipe Welding Bureau
4. Military Specification MIL-STD-248

F. All gas piping 2 psi and above inside the building shall be butt welded.

3.4 SOLDERING/BRAZING

A. Connections between copper tubing and copper sweat fittings shall be made by soldering using Taramet Sterling or approved substitute. Flux shall be non-corrosive type "Nokorode" or approved substitute or as recommended by the manufacturer of the solder.

B. All solder shall be "lead nickel and antimony free" in accordance with the Federal Safe Drinking Water Act Amendments of 1986 and 1996 as is ASTM B-32 Grade TC.

Composition:

Tin	95%
Copper	4.0 – 5.0%
Selenium	.04 - .2%
Tensile Strength	7,130 psi
Shear Strength	5,970 psi
Melting temperature	410°F

C. Tubing shall be cut square and then reamed and deburred. End of tubing and inside of fitting cup shall be cleaned with steel wool and the flux shall be applied to the clean surface before soldering. After soldering, the excess solder shall be wiped off while still plastic.

D. Brazed Joints:

1. All brazed joints shall be cleaned. An approved flux shall be applied; joint filler metal shall conform to AWS A5.8.
2. Flux shall meet AWS Standard A5.31, Type F83-A or F83-C.

E. 410 solder shall be used for all joints in:

1. Domestic cold water

2. Domestic hot water
3. Domestic hot water return
4. Copper drainage piping

F. Lead-Tin (50-50) solder or any solder containing lead shall NOT be used or permitted for joint connections on this project.

G. Where the silver brazing is performed in a confined non-ventilated space, a non-toxic, cadmium-free brazing alloy such as Stay-Brite shall be used instead of Easy-Flo. Bring joint to solder temperature or brazing temperature in as short a time as possible.

H. Form continuous solder bead or brazing filler bead around entire circumference of joint.

I. Wipe excess solder from joint area while solder is still plastic.

J. Solder joints shall be in accordance with IPC Section 605.2, 605.14.3 and ASTM B838. Flux shall conform to ASTM B-813.

3.5 PRESS-FIT SYSTEM

A. All new domestic water piping installed on this project joined with a solderless, press-fit, domestic water system shall be Viega or Nibco copper press fitting system. Fittings shall be rated 0 to 250 at 200 psi and tested to 600 psi.

B. Fittings shall meet ANSI/NSF 61, – ASME B-16.22 and ASTM B88. Elastomeric seals shall meet ASTM D-2000.

C. Mechanical joining shall be recognized by:

IPC International Plumbing Code

SBCCI Standard Plumbing Code

IAPMO Uniform Plumbing Code

PHCC National Standard Plumbing Code

D. Copper and copper alloy press fittings shall conform to material requirements of ASME B16.18 or ASME B16.22 and performance criteria of IAPMO PS 117. Sealing elements for press fittings shall be EPDM. Sealing elements shall be factory installed or an alternative supplied by fitting manufacturer. Press end shall have SC (Smart Connect) feature design (leakage path). Smart Connect™ (SC Feature). In ProPress ½" to 4" dimensions, the Smart Connect Feature assures leakage of liquids and/or gases from inside the system past the sealing element of an unpressed connection. This feature shall provide the installer quick and easy identification of connections which have not been pressed prior to putting the system into operation.

E. Press Connections: Copper press fitting joints shall be made in accordance with the manufacturer's installation instructions. The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool approved by the manufacturer.

F. Installer shall be a qualified installer, licensed within the jurisdiction, and familiar with the installation of ProPress copper press joint systems. ProPress copper press fittings shall be installed using the proper tool, actuator, jaws and rings as instructed by the press fitting manufacturer. The installation of copper tubing for hot and cold-water distribution systems shall conform to the requirements of the ICC International Plumbing Code or IAPMO Uniform Plumbing Code.

G. Note: Viega ProPress or Nibco Press-fit installation shall only be permitted on this project. Push-on shark-teeth, or any type connection fittings that are not ProPress or Press-Fit, shall NOT be approved.

H. T-drill mechanically formed tee fittings shall be used in conjunction with the ProPress Copper System in accordance with the IPC Chapter 6 Section 605.5.1, 605.5.1.2 and 605.14.1. Use caution around combustible material and follow all safety guidelines for open flame during silver brazing.

END OF SECTION

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SECTION 22 05 93

TESTING - PLUMBING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including the Conditions of the Contract (General, Supplementary and other conditions, if any) and Division 1 as appropriate, apply to the work specified in this Section.

1.2 DESCRIPTION OF WORK

A. Extent of plumbing systems to be tested is indicated on the drawings and by requirements of this section.

B. Applications of tests include the following:

1. Interior Piping
   a. Domestic cold, hot & hot water return piping
   b. Gas piping
   c. Sanitary and condensate waste drainage piping
   d. Storm water drainage piping
2. Exterior Piping
   a. Sanitary drainage piping
   b. Domestic water service
   c. Gas service
   d. Storm drainage piping

C. See Fire Protection Specifications for testing of Fire Protection Systems.

1.3 REFERENCE STANDARDS

A. Refer to Section 22 00 00 for a general description of requirements applying to this section.

1.4 QUALITY ASSURANCE

A. Refer to Section 22 05 00 for a general description of requirements applying to this section.

1.5 SUBMITTALS

A. Submit test reports in accordance with Section 22 00 00.

1.6 WARRANTY/GUARANTEE

A. All work and materials are subject to the general warranty as described in the General Conditions of the Contract and in Division 1, GENERAL REQUIREMENTS.

PART 2 – PRODUCTS

2.1 PIPE & FITTING REPLACEMENTS

A. Refer to Section 22 05 00 for replacement of any defective pipe or fittings. Replacement shall include all required uncovering, excavating, recovering and backfilling.

PART 3 – EXECUTION

3.1 GENERAL

A. All exterior or interior piping shall be tested and approved before backfilling or concealing. Failure to secure the approval of the Municipal Inspector, Utility Company's Inspector or the Inspector of the Architect/Engineer makes it mandatory for the Contractor to completely expose the piping for testing.

All expense involved in the uncovering of the piping for the test and recovering shall be borne by the respective Contractor with no change in Contract.

B. All equipment, material and labor required for testing a plumbing system or part thereof shall be furnished by the Plumbing Contractor responsible for installing the work.

3.2 INTERIOR PIPING

A. Drainage Piping:

Rough Plumbing: The piping of all plumbing storm, condensate waste, sanitary drainage and venting systems shall be tested upon completion of the rough piping installation by water or air and proved watertight. Where required by the code official, the cleanout plugs shall be removed to ascertain if the pressure has reached all parts of the system. Either of the following methods shall be used:

1. Water Test: The water test shall be applied to the drainage system either in its entirety or in sections after rough piping has been installed. If applied to the entire system, all openings in the piping shall be closed, except the highest opening, and the system filled with water to the point of overflow. If the system is tested in sections, each opening shall be plugged except the highest opening of the section under test, and each section shall be filled with water, but a section shall not be tested with less than a 10-foot head of water.

   In testing successive sections, at least the upper 10 feet of the next preceding section shall be tested, so that a joint or pipe in the building (except the uppermost 10 feet of the system) shall not have been subjected to a test of less than a 10-foot head of water. The water shall be kept in the system or in the portion under test for a minimum of 15 minutes before inspection starts. The system shall then be tight at all points.

2. Air Test: The air test shall be made by attaching an air compressor testing apparatus to an opening, and, after closing all other inlets and outlets to the system, forcing air into the system until there is a gauge pressure of 5 pounds per square inch (5 psi) or a minimum of 10-inch column of mercury. This pressure shall be held without introduction of additional air for a minimum period of 15 minutes.

   Precautionary Note: The compressibility of air and/or other gases result in tremendous amounts of stored energy, even at lower pressures. Over-pressurizing creates a substantial hazard to personnel and property near the area should a failure occur. Consult with the Plastic Pipe Institute (PPI) for statements and alerts, along with State and local safety offices.

Finished Plumbing: Where required by the code official, after the plumbing fixtures have been set and their traps filled with water, their connections shall be tested and proved gas and water-tight by one of the following test methods.

1. The final test for gas and water-tightness of the completed drainage and vent systems shall be made by a smoke test or other approved method. The test shall be made by filling all traps with water, and then introducing into the system smoke produced by one or more smoke machines. When the smoke appears at stack openings on the roof, the stack openings shall be closed and a pressure equivalent to a 1" water column shall be built and maintained for the period of the inspection.

2. After the plumbing fixtures have been set and their traps filled with water, their connections shall be tested and proven gas and water-tight by plugging the stack openings on the roof and building drain where the drain leaves the building and with air introduced into the system equal to the pressure of a 1-inch water column. This shall be accomplished by the use of a "U" tube or manometer inserted in the trap of a water closet. Such pressure shall remain constant for the period of inspection without the introduction of additional air.

Building sewer test: The building sewer shall be tested by insertion of a test plug at the point of

connection with the public sewer or individual sewage disposal system. The building sewer shall then be filled with water under a head of not less than 10 feet. The water level at the top of the test head of water shall not drop for at least 15 minutes.

B. Domestic Water Piping: All new, altered, extended or replaced interior water piping installed shall be tested at 100 psig maintaining the pressure for four hours with not more than 1% drop in pressure. The system shall be filled with water which shall remain in the system until the water and the piping are the same temperature. If water pipe testing is under the jurisdiction of the local inspector, his requirements shall be used; however, they shall be not less than specified herein. The tests shall be performed in the presence of the representative of the Architect/Engineer and to his satisfaction.

C. Natural Gas Piping:

1. All new, altered, extended or replaced interior natural gas piping installed shall be tested in accordance with the requirements of the latest edition of the International Fuel Gas Code (IFGC), Section 107, and the requirements of the local Utility Company as applicable. In the absence of a specific test required by the Authorities, or if such requirements are less stringent than the test hereinafter specified, then the interior gas piping shall be tested as follows in the presence of the representative of the Architect.
2. Before appliances are connected, piping shall be filled with air or nitrogen, to a pressure of 10 psi and proved tight with no drop in pressure for the length of time required to inspect the joints, but in no case less than 30 minutes. The source of pressure shall be isolated before the pressure tests are performed. Pressure shall be measured with a mercury manometer, or slope gauge or equivalent device so calibrated as to be read in increments of not greater than one-tenth pound. All piping which will be concealed shall be tested, prior to being closed in by construction.

3.3 EXTERIOR PIPING

A. Sanitary & Storm Water Drainage Piping:

1. All new exterior sanitary and storm water drainage installed shall be tested in a manner and in a sequence best suited to project. The test shall be performed in the presence of the Inspector of the Municipality under whose jurisdiction the installation is made and shall conform to his requirements.
2. In the absence of a specific code test, the Contractor shall perform the following testing in the presence of the representatives of the Architect.
3. Before any section of sanitary and storm water drainage has been backfilled more than 6 inches above the top of the pipes, exclusive of the joint area, the system shall be tested. Wherever possible, the section of the system shall be tested from manhole to manhole. The lower end of each section to be tested shall be plugged with a suitable device manufactured for this purpose. The section being tested shall be filled with water and the leakage observed and gauged.
4. For the gravity sanitary drainage piping to be acceptable, the water leakage after filling shall not exceed 2 gallons per 24 hours per lineal foot of pipe joints with all joints under a constant pressure of not less than 0.1 pound.
5. For the storm water to be acceptable, the water leakage after filling shall not exceed 3 gallons per 24 hours per lineal foot of pipe joints with all joints under a constant pressure of not less than 0.1 pound.

B. Gas Service:

1. All new exterior distribution piping, installed by this Contractor, for natural gas systems shall be tested in accordance with the requirements of the latest edition of the International Fuel Gas Code (IFGC), Section 107, and the requirements of the local Utility Company. In the absence of a specific test required by the Authorities, or if such requirements are less stringent than the test

hereinafter specified, then the exterior piping shall be tested as follows, before pressure regulating valves are installed, or connection made to interior piping.

2. Piping shall be filled with air or nitrogen, to a pressure of 100 psi, and proved tight with no drop-in pressure for the length of time required to inspect the joints, but in no case less than one hour. The source of pressure shall be isolated before the pressure tests are performed. Pressure shall be measured with a gauge so calibrated as to be read in increments of not greater than one pound.

3.4 STERILIZATION

A. After final testing for leaks, all new potable water piping installed including water service piping, shall be flushed to remove foreign material.

B. Before placing domestic water systems in service, a qualified service organization shall be engaged, to sterilize the entire building including the exterior water service piping in accordance with the following procedure:

1. Contractor shall provide a 3/4" hose connection somewhere in the main entering the building, or in the Mechanical Room and/or in the meter pit, pump in sufficient sodium hypochlorite to produce a free available chlorine residual of not less than 100 PPM.
2. Proceed upstream from the point of chlorine application opening all faucets and taps until chlorine is detected. Close faucets and taps when chlorine is evident. Consult with the local code department for additional concentrations and durations.
3. When chlorinated water has been brought to every faucet and tap with a minimum concentration of 200 PPM chlorine, retain this water in the system for at least three hours.
4. At the end of the retention period, no less than 100 PPM of chlorine shall be present at the extreme end of the system.
5. Proceed to open all faucets and taps and thoroughly flush all new lines until the chlorine residual in the water is less than 1.0 PPM.
6. Obtain representative water samples from the system for analysis by a recognized Bacteriological Laboratory.
7. If all samples tested for impurities and organisms are negative, a letter and laboratory reports shall be submitted by the service organization to the contractor, certifying successful completion of the sterilization.
8. If any samples tested indicate the presence of harmful impurities and organisms, the entire sterilization procedure shall be repeated.
9. Plumbing Contractor shall provide plumbing connections and power for pumping chlorine solution into the system.

Warning: PVC and CPVC Pipe: Do not use a dry granular calcium hypochlorite as a disinfecting material for water purification in potable water piping systems. The introduction of granules or pellets of calcium hypochlorite with solvent cements and primers (including their vapors), may result in violent chemical reactions.

C. Available Service Organizations: Subject to compliance with requirements, provide the sterilization service of one of the following:

Water Chem

Arc Company, Inc.

Nova Consultants

Artesian Water Co.

END OF SECTION

SECTION 22 05 94
BALANCING – PLUMBING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including the Conditions of the Contract (General, Supplementary and other conditions, if any) and Division 1 as appropriate, apply to the work specified in this Section.

1.2 DESCRIPTION OF WORK

A. Extent of plumbing systems to be balanced is indicated on the drawings and by requirements of this section.

B. Applications of tests include the following:

1. Interior Piping

a. Domestic hot water and hot water return

1.3 REFERENCE STANDARDS

A. Refer to Section 22 00 00 for a general description of requirements applying to this section.

1.4 QUALITY ASSURANCE

A. Refer to Section 22 05 00 for a general description of requirements applying to this section.

1.5 SUBMITTALS

A. Submit balancing report in accordance with Section 22 00 00.

1.6 WARRANTY/GUARANTEE

A. All work and materials are subject to the general warranty as described in the General Conditions of the Contract and in Division 1, GENERAL REQUIREMENTS.

PART 2 – PRODUCTS

2.1 PIPE & FITTING REPLACEMENTS

A. Refer to Section 22 05 00 for replacement of any defective pipe or fittings. Replacement shall include all required draining of system, removal and replacement and uncovering, recovering.

PART 3 – EXECUTION

3.1 GENERAL

A. All new hot water return piping installed or wherever system valves are being replaced, the system shall be tested, balanced and approved before concealing. Failure to secure the approval of the Municipal Inspector, A/E Inspector or the Inspector of the Owner makes it mandatory for the Contractor to completely expose the piping for balancing. All expense involved in the uncovering of the piping for the balancing and recovering shall be borne by the respective Contractor with no change in Contract.

B. All equipment, material and labor required for balancing a plumbing system or part thereof shall be furnished by the Plumbing Contractor responsible for installing the work.

3.2 INTERIOR PIPING

A. Domestic Hot Water Return System: Upon completion of the testing of the domestic hot water supply and recirculation systems, a final procedure is to be performed to obtain uniform circulation within each hot water loop of the domestic hot water system. At the ends of the hot water mains, or wherever a branch return line connects to the main return line, there shall be three (3) valves: ball valve, check valve and balancing valve. These valves are to be installed in an accessible space at/or above the

ceiling or where indicated on the drawings.

B. Based on an Accu-Flo balancing valve, the use of a differential pressure gauge Model No. 779 shall be used to achieve the greatest accuracy.

END OF SECTION

SECTION 22 07 00
PLUMBING INSULATION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including the Conditions of the Contract (General, Supplementary and other Conditions, if any) and Division 1 as appropriate, apply to the Work specified in this Section.

1.2 DESCRIPTION OF WORK

A. This section includes insulation and covering furnished and installed on the following piping systems and equipment:

1. Domestic cold water.
2. Domestic hot water supply and return
3. “Primary” Horizontal rainwater conductors including underside of roof drains. “Secondary” rainwater systems insulation is not required.
4. Condensate waste piping from air conditioning units.
5. Branch waste lines from all chilled water fountains.

1.3 REFERENCE STANDARDS

A. Refer to Section 22 00 00 for a general description of requirements applying to this section.

B. Materials shall conform to the requirements of the NFPA Code.

1.4 QUALITY ASSURANCE

A. Refer to Section 22 05 00 for a general description of requirements applying to this section.

1.5 SUBMITTALS

A. Submit shop drawings and product data in accordance with Section 22 00 00.

B. Submit the following:

1. Product data on all insulation and covering.
2. Provide at project site, a sample of each type of insulation hereinafter specified. Display insulation in an "installed" condition, showing typical completed pipe, fitting, , and equipment insulation. No insulation shall be applied until these samples have been accepted by the Engineer. Any insulation work which does not conform to the accepted samples will not be acceptable, and shall be removed and reinstalled in a manner acceptable to the Engineer.

1.6 WARRANTY/GUARANTEE

A. All work and materials are subject to the general warranty as described in the General Conditions of the Contract and in Division 1, GENERAL REQUIREMENTS.

PART 2 – PRODUCTS

2.1 PIPE INSULATION MATERIAL

A. Fiberglass:

1. Material: Preformed fiberglass bonded with resins to form circular pipe sleeves with factory applied, white all-service jacket bonded to reinforced foil vapor barrier jacketing. The jacket shall have factory-applied double pressure-sensitive adhesive closure and vapor sealing of longitudinal joints. Thermal Conductivity: .25 per inch at 100 degrees F. Flame spread of 25 and developed smoke of 50 or less.

2. All Valves and Fittings:
   a. Class fiber insert and pre-molded PVC cover, Manville "Zeston" and "Hi-Lo Temp Inserts" for valves and fittings.
   b. Factory molded fibrous glass fitting covering for fittings.
   c. Mitered sections of pipe covering for valves.
3. Manufacturers: Johns-Manville, Certain-Teed, Owens-Corning.

B. Closed Cell:
1. Material: Flexible elastomeric foamed plastic closed cell structure insulation 25/50 rated with a flame spread rating of 25 or less and a smoke developed rating of 50 or less.
2. Flexible pipe insulation shall be a foamed plastic closed cell structure material, with a thermal conductivity of not more than 0.27 Btu/Hr./Sq. Ft./Inch at a mean temperature of 75 degrees F. The insulation shall have an average density of at least 2 pounds per cubic foot, shall be self-extinguishing, and shall have a water vapor transmission rating of not more than 0.1 perms. Between temperature limits of -40 degrees F and plus 220 degrees F, the insulation shall not indicate any deviation from its original state.
3. Manufacturers: Armacel, Insul-Tube, Nomaco Insulation.
4. Specification Compliance: (Latest accepted Standards and Codes)

IECC 804.5:	Insulation thickness for domestic hot and recirculation mains.
ASTM-E-84	Flame spread and smoke developed.
NFPA 255:	Standard method of test of surface burning of building materials.
ASTM C177:	Thermal conductivity.
NFPA 90A, 90B:	Flame & smoke rating
ASTM-C-534 Type 1 Tubular Grade, Self-Sealing	
UL 181	Factory made air ducts and air connectors. (Armacell UL181 has to do with mold growth)
UL723	Test for surface burning characteristics of building materials.
ASTM G21/C1338:	Fungi resistance
ASTM G2:	Bacterial Resistance
ASTM D1056, 2B1:	Standard spec for flexible cellular materials.
MIL-P-15280J, FORMT	
MIL-C-3133B (MIL STD 670B) Grade SBE-3	
MEA 96-85M	

C. Covering of Pipe Insulation Outdoors:
1. Wrapping: Wrap insulation with embossed .016" aluminum jacket.
2. Fastenings: Cover shall be held in place with soft aluminum bands on 12" centers.
3. Valves and Fittings: Weatherproof all valves and fittings.
4. Manufacturers: Johns-Manville, Certain-Teed, Owens-Corning, Knauf.

D. Protective cover for foam insulation in wet areas indoors:
1. PVC heavy duty fitting covers and jacketing for kitchen wet areas.
2. Fitting covers shall be glossy white, high impact, UV resistant PVC.

3. Operating Temperature Limit: Up to 150ºF.
4. Flame Spread: 25 or less.
5. Smoke Developed: 50 or less.
6. Grade: Weatherable.
7. Color: White
8. Finish: Gloss
9. Fitting covers and jacketing shall be “Zeston” 300 Series PVC, heavy duty covers and “Zeston” PVC jacketing.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Do not install until systems have been tested and meet requirements.

B. Do not install until building is closed in.

C. Heavy work which may damage insulation shall have been completed in the vicinity of the insulation work.

D. All installations shall be made by skilled craftsmen regularly engaged in this type of work.

E. Insulation shall be continuous thru-wall, ceiling and floors.

F. Pipe and equipment to be clean and dry prior to insulating.

G. Install all insulation in strict conformance with manufacturer's instructions.

H. Where "Barrier-free" lavatory supplies and waste are covered with a protective covering or insulation, the insulation must be installed back to wall, flush with wall escutcheon. Escutcheon to be finished flush with wall and wall opening to be smaller than escutcheon plate through entire building.

I. All electrical heat tracing installations shall be coordinated with the electrical contractor. No insulation shall be installed until the heat trace wiring is completely installed, tested and approved. All insulation materials and installation work shall be the responsibility of the Insulation Contractor.

J. Install pipe insulation by slitting tubular sections and applying onto piping or tubing. Alternately, whenever possible, slide unslit sections over the open ends of piping or tubing. All seams and butt joints shall be adhered and sealed using Armaflex 520 or 520 BLV Adhesive. If when using AP Armaflex SS, only the butt joints shall be adhered using Armaflex 520 or 520 BLV Adhesive, Armaflex HT 625 Adhesive shall be used with HT Armaflex.

K. Insulation shall be pushed onto the pipe, never pulled. Stretching of insulation may result in open seams and joints.

L. Tape the ends of the copper tubing before slipping the Armaflex insulation over the new pipes to prevent dust from entering the pipe.

M. All edges shall be clean cut. Rough or jagged edges of the insulation shall not be permitted. Proper tools such as sharp, non-serrated knives must be used.

N. On cold piping, insulation shall be adhered directly to the piping at the high end of the run using a two-inch strip of Armaflex 520 or 520 BLV Adhesive on the ID of the insulation and on the pipe. All exposed end cuts of the insulation shall be coated with Armaflex 520 or 520 BLV Adhesive. All penetrations through the insulation and termination points must be adhered to the substrate to prevent condensation migration.

O. Sheet insulation shall be used on all pipes larger than 6” IPS. Insulation shall not be stretched around the pipe. On pipes larger than 12” IPS, adhere insulation directly to the pipe on the lower 1/3 of the pipe.

P. Seams shall be staggered when applying multiple layers of insulation.

3.2 VALVES, FLANGES AND FITTINGS:

A. All fittings shall be insulated with the same insulation thickness as the adjacent piping. All seams and mitered joints shall be adhered with Armaflex 520 or 520 BLV Adhesive. Screwed fittings shall be sleeved and adhered with a minimum 1” overlap onto the adjacent insulation. Armaflex HT 625 Adhesive shall be used with HT Armaflex.

B. Valves, flanges, strainers and Victaulic couplings shall be insulated using Armaflex donuts that shall then be covered with sheet or oversized tubular insulation.

3.3 HANGERS

A. Support piping system using high density inserts with sufficient compressive strength. The pipe support insulation shall be elastomeric foam with the same or greater thickness than the pipe insulation. All joints shall be sealed with Armaflex 520 or 520 BLV adhesive.

B. Standard and split hangers: Piping supported by ring hangers shall have hangers insulated with the same insulation thickness as the adjacent pipe. All seams and butt joints shall be sealed with Armaflex 520 or 520 BLV Adhesive. Armaflex HT 625 Adhesive shall be used with HT Armaflex. Ring hangers may be sleeved using oversized tubular insulation. On cold piping, insulation shall extend up the hanger rod a distance equal to four times the insulation thickness. Insulation tape may be used to a thickness equal to the adjacent insulation thickness.

C. Clevis Hangers or other pipe support systems: Saddles shall be installed under all insulated lines at unistrut clamps, clevis hangers or locations where the insulation may be compressed due to the weight of the pipe. All piping shall have wooden dowels or blocks of a thickness equal to the insulation inserted and adhered to the insulation between the pipe and the saddle.

It is highly recommended for continuous insulation protection to use hanger sizes equal to the outer diameter of the pipe plus insulation thickness

D. Armafix IPH o Armafix NPH can be used to prevent compression of insulation at standard split, clevis hangers or other pipe support systems. To minimize the movement of Armafix, it is recommended that a pair of non-skid pads be adhered to the clamps. In addition, to prevent loosening of the clamps, use of an antivibratory fastener, such as a nylon-locking nut, is also recommended.

3.4 OUTDOORS EXPOSED PIPING

A. All outdoor exposed piping shall be painted with two coats of WB Armaflex Finish. Prior to applying the Finish, the insulation shall be wiped clean with denatured alcohol. The Finish shall not be tinted.

B. All outdoor exposed piping shall have the seams located on the lower half of the pipe.

3.5 EXTERIOR PIPE COVERING

A. Wrapping: Wrap insulation with embossed .016" aluminum jacket.

B. Fastenings: Cover shall be held in place with soft aluminum bands on 12" centers.

C. Valves and Fittings: Weatherproof all valves and fittings.

D. Finish: Apply two coats of vapor resistant mastic reinforced with glass fabric over wrapping.

3.6 PIPE COVERING (FOAMED PLASTIC TYPE)

A. All joints and seams shall be sealed with a compatible adhesive. Approved adhesives are as follows:

Armacel	No. 520 (Low VOC use 520 BLV
Benjamin Foster Company	No. 85-75 up to 200 degrees F.

Contractor may use self-sealing insulation in lieu of above.

B. Fitting covers shall be fabricated from the foamed plastic pipe insulation or from sheet insulation of

the identical material. The fabrication shall be in accordance with manufacturer's instructions, and all seams mitered joints shall be joined using the adhesives described.

3.7 PIPE INSULATION – TYPES & THICKNESSES

A. Flexible Closed Cell:

Piping System	Up to 3"	Over 3" to 6"	Over 6"
Cold Water	½"	½"	¾"
Hot Water (120º)	1"	1"	1-1/2"
Hot Water Return (120º)	1"	1"	1-1/2"
Hot Water (140º)	1"	1"	1-1/2"
Hot Water Return (140º)	1"	1"	1-1/2"
Condensate Waste	½"	½"	-
Horizontal Storm (Primary)	½"	½"	¾"
Horizontal Storm (Secondary)	-----Not Required-----		
Underside of Roof Drains	½"	½"	¾"
Branch Waste From EWC's	½"	---	---
Handicap Lav Waste & Water	½"	---	---
Soil/Waste Piping Above Ceiling	½"	½"	¾"

B. Fiberglass:

Piping System	Up to 3"	Over 3" to 6"	Over 6"
Cold Water	½"	½"	¾"
Hot Water	1"	1"	1-1/2"
Hot Water Return	1"	1"	1-1/2"
Hot Water	1"	1"	1-1/2"
Hot Water Return	1"	1"	1-1/2"
Condensate Waste	½"	½"	---
Horizontal Storm (Primary)	½"	½"	¾"
Horizontal Storm (Secondary)	½"	½"	¾"
Underside of Roof Drains	½"	½"	---
Soil/Waste Piping Above Ceiling	½"	½"	¾"

END OF SECTION

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SECTION 22 10 00
PLUMBING PIPING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including the Conditions of the Contract (General, Supplementary and other Conditions, if any) and Division 1 as appropriate, apply to the work specified in this Section.

1.2 DESCRIPTION OF WORK

A. This Section includes:

1. Domestic water piping systems work is indicated on drawings and schedules and by requirements of this section.

B. Applications for water piping systems include the following:

1. Domestic cold water piping.
2. Domestic hot-water piping.
3. Domestic recirculating-water piping.

D. Complete flow balancing of the entire domestic hot water return system.

E. Insulation for domestic water piping as specified in Section 22 07 00 is included as work of this section.

1.3 REFERENCE STANDARDS

A. Refer to Section 22 00 00 for a general description of requirements applying to this section.

1.4 QUALITY ASSURANCE

A. Refer to Section 22 05 00 for a general description of requirements applying to this section.

1.5 SUBMITTALS

A. Submit shop drawings and product data in accordance with Section 22 00 00.

B. Submit the following:

1. Product data on all specialties and systems equipment.

1.6 WARRANTY/GUARANTEE

A. All work and materials are subject to the general warranty as described in the General Conditions of the Contract and in Division 1, GENERAL REQUIREMENTS.

PART 2 – PRODUCTS

2.1 DOMESTIC WATER PIPING MATERIALS AND PRODUCTS

A. Provide piping materials and factory fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in domestic water piping systems. Where more than 1 type of materials or products are indicated, selection is Installer's option.

2.2 BASIC PIPE, TUBE AND FITTINGS

A. Provide pipe, tube, and fittings complying with Division 22 Common Work Results for Plumbing section "Pipe, Tube, and Fittings", in accordance with the following listing:

B. Interior Domestic Water Piping:

Tube Size 4" and Smaller:	Copper tube.
Wall Thickness:	Type "L" hard-drawn temper (Type “K” for underground)
Fittings:	Wrought-copper, solder-joints (No joints for underground)

2.3 BASIC PIPING SPECIALTIES

A. Provide piping specialties complying with Section 22 05 00, Common Work Results for Plumbing, in accordance with the following listing:

Pipe escutcheons

Dielectric unions

Drip pans

Pipe sleeves

Sleeve seals

2.4 SPECIAL PIPING SPECIALTIES

A. Water Hammer Arresters: Provide bellows or piston type water hammer arresters, pressure rated for 250 psi, tested and certified in accordance with PDI Standard WH-201.

2.5 BASIC VALVES

A. Provide valves complying with applicable Division 22 sections "Valves", in accordance with the following listing:

B. Sectional Valves:

2-1/2" and Smaller:	Ball Valves.
	Gate Valves.
3” and Larger:	Ball Valves.
	Butterfly Valves.

C. Shutoff Valves:

2-1/2" and Smaller:	Ball Valves.
	Gate Valves
3" and Larger:	Ball Valves.
	Butterfly Valves.

D. Drain Valves:

All	Hose End Threaded Gate or Ball Valves.

E. Balancing Valves:

2" and Smaller:	Ball Valves (Circuit Setter Type).
	(w/ Memory Stop)

F. Check Valves:

All Sizes:	Swing Check Valves. Horizontal Installations
	Spring Check Valves. Vertical Installations

2.6 SPECIAL VALVES

A. Special valves required for domestic water piping systems include the following types:

B. Hose Bibbs: Threaded end, renewable composition disc, tee handle, 3/4" NPT inlet, 3/4" hose outlet with vacuum breaker.

1. Finished Areas: Chrome plated.
2. Unfinished Areas: Bronze finish.

C. Wall Hydrants: Non-freeze, cast-bronze body, tee handle key, bronze casing, length to suit wall thickness, vacuum breaker, hinged locking cover, 3/4" inlet, hose outlet.

2.7 BASIC THERMOMETERS AND GAUGES

A. Provide thermometers and gauges complying with Division 22 Common Work Results for Plumbing Section "Meters and Gauges", in accordance with the following listing:

Pressure gauges

Glass thermometers

Pressure and temperature connections

2.8 BASIC PUMPS

A. Provide pumps as specified in applicable Section 22 30 00 Plumbing Equipment. Use inline pumps for hot water recirculating.

2.9 SYSTEMS EQUIPMENT MANUFACTURERS

A. Refer to Plumbing Fixture and Equipment Schedule for type, number, size and manufacturer of all equipment and accessories.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering equipment which may be incorporated in the work are limited to the following:

<u>Shock Absorbers:</u>

Zurn

Josam

Wade

Watts

Smith

PPP Inc.

MIFAB

<u>Hose Bibbs</u>

Zurn

Josam

Wade

Watts

Smith

Woodford

MIFAB

Nibco

<u>Wall Hydrants</u>

Zurn

Josam

Wade

Watts

Smith

Woodford

MIFAB

Nibco

PART 3 – EXECUTION

3.1 INSTALLATION OF BASIC IDENTIFICATION

A. Install mechanical identification in accordance with Section 22 05 00 Common Work Results for Plumbing.

B. Support vertical piping at floor levels using approved riser clamps. Clamp material shall be compatible with pipe material. Maximum vertical spacing shall be 10’-0”. Domestic water piping shall be supported in accordance with the International Mechanical Code, Section 305 and Table 305.4 Spacing Intervals, or in accordance with MSS-SP-69. International Plumbing Code’s latest edition, Section 308.5, accept as follows:

1. Copper tubing ½” to 1-1/4” nominal size, not to exceed 6 ft. horizontal intervals.
2. Copper tubing 1-1/2” and larger nominal size, not to exceed 10 ft. horizontal intervals.
3. Copper tubing ½” to 1-1/4” nominal size, not to exceed 10 ft. vertical intervals.
4. Copper tubing 1-1/2” and larger nominal size not to exceed 10 ft. vertical intervals.

3.2 INSTALLATION OF DOMESTIC WATER SERVICE SYSTEM - BUILDING

A. Install water distribution system in accordance with Section 22 05 00 Common Work Results for Plumbing, and the International Mechanical Codes Section 305, and Support Intervals under Tables 305.4 and 308.5 or in accordance with MSS-SP-69.

3.3 INSTALLATION OF PIPING SPECIALTIES

A. Install piping specialties in accordance with Section 22 05 00 Common Work Results for Plumbing.

B. Water Hammer Arresters: Install in upright position, in locations and of sizes in accordance with PDI Standard WH-201, and elsewhere as indicated.

3.4 REACTION BACKING

A. All plugs, tees and elbows in the underground piping shall be provided with reaction backing consisting of concrete placed between solid undisturbed earth and the fitting to be anchored. Concrete shall be of such bearing area as to assure adequate resistance to the thrust to be encountered. In general, backing shall be so placed that the joint will be accessible for inspection and repair.

3.5 INSTALLATION OF VALVES

A. Install valves in accordance with Division 22 Common Work Results for Plumbing section, "Valves".

B. Sectional Valves: Install on each branch and riser, close to main, where branch or riser serves 2 or more fixtures, equipment connections, and elsewhere as indicated.

C. Shutoff Valves: Install on inlet of each plumbing equipment item, and on inlet of each plumbing fixture, and elsewhere as indicated.

D. Drain Valves: Install on each plumbing equipment item located to completely drain equipment for service or repair. Install at base of each riser, at base of each rise or drop in piping system, and elsewhere where indicated or required to completely drain domestic water piping system.

E. Check Valves: Install on discharge side of each pump, and elsewhere as indicated.

F. Balance Cocks: Install in main recirculating loop and in each branch hot water recirculating loop. Install a ball valve and check valve at each balance valve installation.

G. Hose Bibbs: Install on exposed piping where indicated, with vacuum breaker.

3.6 INSTALLATION OF BACKFLOW PREVENTERS

A. Install backflow preventers where indicated, and where required by International Plumbing Code. Locate in same room or area as equipment being protected.

3.7 INSTALLATION OF EXPANSION COMPENSATION PRODUCTS

A. This project shall require the installation of expansion compensators.

B. Furnish and install expansion compensation products in accordance with Section 23 05 00 Common Work Results for HVAC.

3.8 INSTALLATION OF THERMOMETERS AND GAUGES

A. Install thermometers and gauges in accordance with Section 22 05 00 Common Work Results for Plumbing.

3.9 EQUIPMENT CONNECTIONS

A. Piping Runouts to Fixtures: Provide hot and cold water piping runouts to fixtures of sizes indicated, but in no case smaller than required by International Plumbing Code.

B. Equipment furnished by the Owner or Contractors other than this Contractor: After equipment has been set in place, this Contractor shall furnish all labor and material required to make final connections, between roughing-in and the equipment. Install valves, fittings, trim and appurtenances furnished with the equipment. All exposed piping in the kitchen areas shall be chrome plated. Piping in other areas shall be of the same material as the system to which it connects.

3.10 SPARE PARTS

A. Furnish to Owner, with receipt, one valve key for each key operated hydrant, bibb, or faucet installed.

3.11 KITCHEN DOMESTIC WATER

A. All kitchen domestic water system piping shall be roughed-in and strictly coordinated with the kitchen equipment drawings.

B. Provide all rough-in piping and final connections to equipment furnished by the Kitchen Equipment Contractor (KEC). This also includes any equipment items furnished by the KEC and are to be completely installed by the Plumbing Contractor.

C. Verify all responsibilities during the bid phase of the work.

D. All piping shall be supported off the wall with split ring clamps or uni-strut.

E. All piping shall be insulated and identified.

F. Provide shut-off valves and stainless-steel flex hose connections to all individual equipment connections.

G. All exposed piping shall be chrome plated brass.

3.12 DOMESTIC HOT WATER RETURN

A. This Contractor shall install complete and operating hot water return system. The system shall be balanced and include a report as required in HVAC Specification Section 23 05 93.

B. Balancing Valves are required in the system as hereinbefore specified. The system shall also include the installation of “air bleed” or “burp” valves to remove any trapped air in the system.

C. Where emergency showers are installed with thermostatic mixing valve, they shall require the installation of a hot water return line as detailed on the drawings.

END OF SECTION

SECTION 22 13 00
FACILITY SANITARY SEWERAGE

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including the Conditions of the Contract (General, Supplementary and other Conditions, if any) and Division 1 as appropriate, apply to the work specified in this Section.

1.2 DESCRIPTION OF WORK

A. This section includes:

1. Soil and waste piping system work as indicated on drawings and schedules, and by requirements of this section.
2. Applications for soil and waste piping systems include the following:
   a. Above ground soil, waste and vent piping within buildings including soil stacks, vent stacks, horizontal branches, traps and connections to fixtures and drains.
   b. Underground building drain piping including mains, branches, traps, connections to fixtures and drains, and connections to stacks, extension from the building, terminating at connection to site sewer.
3. Storm water drainage piping as indicated on drawings and by requirements of this section.
4. Applications for storm water drainage piping include the following:
   a. Roof drains and connections to gutters, with rain water conductors and connections to underground building storm drains.
   b. Underground building storm drains, extending and connecting to site drainage system.
5. Insulation for soil and waste and storm water drainage as specified in Section 22 07 00 is included as work of this section.
6. Trenching and backfilling required in conjunction with underground building drainage and site drainage piping as specified in Section 22 00 00 is included as work of this section. Refer to Division I.
7. Installation of detectable metallic underground tape for <u>all</u> exterior buried PVC drainage piping.

1.3 REFERENCE STANDARDS

A. Refer to Section 22 00 00 for a general description of requirements applying to this section.

1.4 QUALITY ASSURANCE

A. Refer to Section 22 05 00 for a general description of requirements applying to this section, and a listing of all applicable codes.

1.5 SUBMITTALS

A. Submit shop drawings and product data in accordance with Section 22 00 00.

B. Submit the following:

1. Product data on all systems equipment.

C. See requirements for submission of cross-referencing information.

1.6 WARRANTY/GUARANTEE

A. All work and materials are subject to the general warranty as described in the General Conditions of the Contract and in Division 1, GENERAL REQUIREMENTS.

PART 2 – PRODUCTS

2.1 PIPING UNDERGROUND

A. Interior:

1. Sanitary, storm water and condensate waste drainage piping within the building and extending beyond the building wall, unless otherwise noted on the plans shall be an option selection of a, b, or c below:
   a. Service weight hub and spigot pattern cast iron soil pipe and fittings with neoprene gaskets.
   b. Hubless cast iron soil pipe and fittings with cast iron coupling clamps and gaskets or heavy duty 3.04-.016" thick stainless-steel bands.
   c. PVC Schedule 40 pipe and fittings with solvent cement joints.
2. Kitchen Sanitary Drainage and/or Mechanical Room Sanitary Drainage: All Kitchen and/or Mechanical Room sanitary below slab piping and fittings shall be service weight cast iron hub and spigot fitting with butyl rubber gaskets or hubless fittings with heavy duty couplings (no PVC shall be acceptable).

2.2 PIPING ABOVE GROUND

A. All above ground storm water, condensate, soil, waste and vent piping shall be:

1. Hubless cast iron soil pipe with cast iron drainage fittings, couplings and stainless steel clamp bands for piping 2" and larger.
2. Copper tubing, type DWV with wrought copper solder type drainage fitting for piping smaller than 2" in size.

2.3 CONDENSATE WASTE PIPING SYSTEM

A. All aboveground condensate waste piping including connection to equipment shall be:

1. Copper tubing, type DWV with wrought copper solder type drainage fittings.

2.4 FLASHING

A. All vents extending through the roof shall be flashed by the General Contractor. However, the Plumbing Contractor shall furnish and install the necessary counterflashing consisting of a Jay R. Smith Figure 1748 counterflashing fitting, or approved substitute as manufactured by Josam or Zurn. Vents shall terminate 18" above the roof.

2.5 SPECIAL EXPANSION COMPENSATION

A. Special expansion compensation products required for storm, condensate, soil and waste piping systems include the following types:

B. Cast Iron Drainage System Expansion Joints: Cast-iron body, adjustable bronze sleeve, bronze bolts with wing nuts; for vertical installation only.

C. PVC Drainage System Expansion Joints: Factory prelubricated "O" ring expansion joint fitting. Installation must be in strict conformance with manufacturer's recommendations.

D. Available Manufacturers: Subject to compliance with requirements. Manufacturers offering expansion joints which may be incorporated in the work include:

1. Cast Iron Piping Systems - J.R. Smith or approved substitute.
2. PVC Piping Systems – George Fisher or approved substitute.

2.6 SYSTEMS EQUIPMENT

A. Refer to Plumbing Fixture and Equipment Schedule for type, number, size and manufacturer of all drainage equipment and accessories.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering drainage equipment which may be incorporated in the work are limited to the following:

Floor Drains (all types)

Zurn

Josam

Wade

Watts

Smith

MIFAB

J.R. Smith

Roof Drains

Zurn

Josam

Wade

Watts

Smith

MIFAB

J.R. Smith

Cleanouts

Zurn

Josam

Wade

Watts

Smith

MIFAB

J.R. Smith

C. Cross Reference Identification:

1. If the Contractor selects a manufacturer of drainage equipment products other than as identified on the Schedule but is selected from the available manufacturers listed above, a cover sheet shall be included with the submission of shop drawings indicating the cross-referenced manufacturer and model number.
2. Shop drawings shall not be reviewed or accepted if not in compliance with this requirement.

PART 3 – EXECUTION

3.1 INSTALLATION OF SOIL AND WASTE PIPING

A. The Plumbing Contractor shall install a complete system of sanitary drainage piping as shown on the drawings. All drainage lines shall be properly run, trapped and vented in accordance with the local Plumbing Code and all dry vents, back vents, loop vents, revents or special vents required by the Code shall be furnished and installed by the Plumbing Contractor.

B. Drainage lines of the sizes shown on the drawings shall be extended within the building with branches connecting to the base of all soil, waste and vent stack, etc., leaving outlets for connection to all

fixtures, floor drains, as required.

C. All changes in direction of drainage piping shall be installed with "Y" branches and 1/8 bends. All stacks shall be supported with concealed pipe clamps or hangers as required and the openings in the roof for the vent pipes will be provided by this Contractor.

D. All drainage piping which will be located above suspended ceilings shall be checked for slope to assure positive drainage, prior to installation of the ceilings. Pressure tests for leaks, as hereinafter specified, shall also be performed prior to ceiling installation.

E. Install soil and vent piping pitched to drain at minimum slope of 1/4" per foot (2%) for piping 2" and smaller, and 1/8" per foot (1%) for piping 4" and larger.

F. Vertical to horizontal change in direction to be made with long radius fittings.

G. Support all soil and waste piping per IPC Section 308.5, 308.6 and 308.7.

3.2 INSTALLATION OF STORM WATER DRAINAGE PIPING

A. Connect piping to roof drains and outlets provided in gutters, install rainwater conductors and extend to underground storm building drains as indicated.

B. Underground storm building drains shall be extended from the building, terminating beyond the building wall.

C. All changes in direction of drainage piping shall be installed with "Y" branches and 1/8 bends. All stacks shall be supported with concealed pipe clamps or hangers as required, and the openings in the roof for the vent pipes will be provided by this Contractor.

D. All drainage piping which will be located above suspended ceilings shall be checked for slope to assure positive drainage, prior to installation of the ceilings. Pressure tests for leaks, as hereinafter specified, shall also be performed prior to ceiling installation.

E. Install storm water drainage piping pitched to drain at minimum slope of 1/8" per foot (1%) for piping 4" and larger.

F. Vertical to horizontal change in direction to be made with long radius fittings.

3.3 INSTALLATION OF SPECIAL EXPANSION COMPENSATION PRODUCTS

A. Expansion Joints: Install expansion joints on vertical risers as indicated, and/or as required by International Plumbing Code.

B. PVC piping systems in multi-story (four stories or more) shall require "O" ring expansion joints to compensate for length changes in soil, waste and vent stacks. Expansion joints shall be required at every floor level for soil and waste stack and at alternate floors for vent stacks and rainwater conductors.

3.4 INSTALLATION OF CLEANOUTS

A. Cleanouts: Install in sanitary piping and storm conductor and building drain piping as indicated, and/or as required by International Plumbing Code; at each change in direction of piping greater than 45 degrees; at minimum intervals of 100' for all size straight run piping; and at base of each conductor. Install floor and wall cleanout covers for concealed piping, select type to match adjacent building finish.

3.5 INSTALLATION OF FLOOR DRAINS (ALL TYPES)

A. Install floor drains in accordance with manufacturer's written instructions and in locations indicated.

B. Install floor drains at low points of surface areas to be drained, or as indicated. Set tops of drains flush with finished floor.

C. Install drain flashing collar or flange so that no leakage occurs between drain and adjoining flooring.

Maintain integrity of waterproof membranes, where penetrated.

D. Position drains so that they are accessible and easy to maintain.

E. All floor drains shall be provided with trap primer connections. All floor drains shall have a trap primer discharge line connected to the outlet.

F. All exposed drainage piping shall be DWV copper pipe and fittings. All piping shall be rigidly supported off the wall with split ring clamps or uni-strut.

3.6 INSTALLATION OF ROOF DRAINS

A. Install drains in accordance with manufacturer's written instruction and in location indicated.

B. Coordinate with roofing as necessary to interface roof drains with roofing work.

C. Install drains at low points of surface areas to be drained, or as indicated.

D. Install drain flashing collar or flange so that no leakage occurs between drain and adjoining roofing. Maintain integrity of waterproof membranes, where penetrated.

E. Position drains so that they are accessible and easy to maintain.

F. The roof drain specified is a combination “Primary and Secondary” arrangement. Verify the correct outlet connections to their respective systems.

3.7 UNDERGROUND METALLIC TAPE

A. All exterior underground PVC drainage piping (sanitary, storm, condensate waste) shall be provided with detectable metallic underground tape.

B. Tape shall be similar to Lineguard Maintenance Systems as provided by Utility Supply of America 800-548-1234 or approved substitute as manufactured by Seton.

C. Installation shall comply with manufacturer’s recommendations and shall be installed in the backfill after refilling the trench opening completely, and allowed to settle to the desired 4” to 6” depth. The Contractor shall install the tape after final lifts in compaction backfilling or unroll it before final restoration or installation of sod, black dirt, seeding, etc.

D. The tape system shall be installed under the supervision of the Owner’s Representative. When the tape system is complete, the Contractor shall provide a test using the tape manufacturer’s recommended detection device, to prove the integrity of the installation with the Owner’s Representative.

3.8 INVERTS AND ELEVATIONS

A. Indicated inverts and elevations of existing utilities are approximate and based on the best information available. Upon award of Contract, Contractor shall verify in the field all such information and report any discrepancies to the Engineer before proceeding with work.

3.9 PIPING INSTALLED IN FILLED GROUND

A. Piping located below floor slab in filled areas shall be supported either from the floor slab, or with masonry piers to undisturbed earth. Drainage piping shall be supported at each joint. Exterior piping located in filled areas shall be supported with piers.

B. Details of supports and method of installation shall meet with the approval of the Engineer.

3.10 INSPECTION

A. The Plumbing Contractor shall, upon completion of the drainage systems, secure from the Inspector and/or the Municipality under which the installation was made and inspected, certificates or letters of approval indicating the system has been installed satisfactorily. The Plumbing Contractor shall certify that all inspection fees, permits and charges have been duly paid.

3.11 BUILDING DRAINAGE SYSTEM CLEANING AND CAMERA VIDEO TAPE/TRANSMITTER

A. The Plumbing Contractor shall hire the services of Tri-State Grouting (302) 286-0701, Contact: Bert Andrus.

B. The Camera-Video tape/transmitter work shall be executed for the benefit of the Plumbing Contractor to locate all existing below-floor slab sanitary and storm water drainage systems. This work shall be done to verify exact locations where new piping systems shall connect to existing piping systems.

C. When all plumbing work is complete and before final test of the drainage systems, the entire building active below-slab storm and sanitary waste systems, including all short run and small pipe laterals, shall be power flushed and cleaned to clear all or any obstructions in the line. The work shall include all stack systems through each (VTR) vent thru roof and roof drain to the exterior laterals that exit the building.

END OF SECTION

SECTION 22 30 00
PLUMBING EQUIPMENT

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including the Conditions of the Contract (General, Supplementary and other Conditions, if any) and Division 1 as appropriate, apply to the Work specified in this Section.

1.2 DESCRIPTION OF WORK

A. This section includes:

1. Plumbing equipment as indicated on drawings and provisions of this section, including schedules and equipment lists associated with either drawings or this section.
2. Types of plumbing equipment required for project include the following:

   Recirculating Pumps-Domestic Water Return (110 degrees & 140 degrees)

   Domestic Water Heater

   Thermostatic Mixing Valve

   Covers, Grates and Frames

1.3 REFERENCE STANDARDS

A. Refer to Section 22 00 00 for a general description of requirements applying to this section.

B. UL and NEMA Compliance: Provide electric motors and electrical components required as part of plumbing equipment, which have been listed and labeled by Underwriters' Laboratories and comply with NEMA Standards.

C. NEC Compliance: Comply with National Electrical Code (ANSI/NFPA 70) as applicable to installation and electrical connections of ancillary electrical components of plumbing equipment.

D. ASME Relief Valve Stamps: Provide water heaters with safety relief valves bearing ASME valve markings.

E. AWWA Compliance: Comply with applicable American Water Works Association Standards pertaining to steel water tanks.

F. CSA and NSF Labels: Provide water tanks which have been listed and labeled by CSA International and National Sanitation Foundation.

G. ASME Code Symbol Stamps: For the following equipment, comply with ASME Boiler & Pressure Vessel Code for construction and stamp with ASME Code Symbol:

   Packaged Domestic Water Heater

H. All packaged equipment shall be independently third party, labeled as a system for its intended use by a nationally recognized testing laboratory (NRTL) in accordance with OSHA Federal Regulations 29CFR 1910.303 and .349 as well as NFPA Pamphlet #70 and NEC Article 90.7.

1.4 QUALITY ASSURANCE

A. Refer to Section 22 05 00 for a general description of requirements applying to this section.

1.5 SUBMITTALS

A. Submit shop drawings and product data in accordance with Section 22 00 00.

B. Submit the following:

1. Product data on all equipment including roughing-in data.

2. Connection diagrams for related piping and specialties.

1.6 WARRANTY/GUARANTEE

A. All work and materials are subject to the general warranty as described in the General Conditions of the Contract and in Division 1, GENERAL REQUIREMENTS

PART 2 – PRODUCTS

2.1 EQUIPMENT

A. Refer to "Plumbing Fixture & Equipment Schedule" for type, numbers, size and manufacturer of all equipment accessories.

2.2 HOT WATER CIRCULATING PUMPS

A. Provide and install as indicated in the Plumbing Fixture and Equipment Schedule on the drawings, domestic hot water circulating pumps complete with controls and piping as shown on the drawings.

B. Pumps shall be close coupled, centrifugal type, all low lead or lead-free bronze with flexible connection.

C. Pump shall be controlled by a manual starter, furnished and installed by the Electrical Contractor. Pumps shall run continuously and be wired into night setback operations.

2.3 MASTER MIXING VALVE

A. Mixing valve shall be constructed entirely of lead free bronze and copper and hydrostatically tested to a pressure of 300 lb. Unit shall be provided with the following features.

1. A long mixing chamber with vanes at an angle to the longitudinal axis of the valve which shall cause a thorough mixing of the hot and cold water.
2. The length of the hydraulic thermostatic element shall assure effective contact with the water.
3. The thermostatic element shall be placed in the body of the valve where the hot and cold-water mix. Unit shall be sensitive to any change in water temperature and make the proper correction by opening or closing the hot and cold-water inlets in the valve.
4. The sensitive parts of the thermostatic element shall be inside a heavy non-ferrous tube which shall protect them from any corrosive or scaling action caused by the continuous flow of water past them.

B. Unit shall be as sized on the drawings.

C. Temperature adjusting range shall be between 80 and 160 degrees F.

2.4 WATER HEATER

A. Water heater shall be the manufacturer with a storage capacity input BtuH, and a minimum of 451 GPH at 100 deg. F recovery, as indicated in the Plumbing Fixture and Equipment Schedule on the drawings. It shall be design certified by the CSA International Z21.10.3 for 180 deg. F application. The tank shall be lined with Vitraglas vitreous enamel. The tank shall have one extruded magnesium anode rod. The insulation shall be foam material of 1" nominal thickness. The entire installation shall be made in accordance with state and local codes and ordinances.

B. Vacuum Relief Valve: All bottom fed water heaters and bottom fed hot water storage tanks connected to water heaters shall be installed with a vacuum relief valve. The valve shall be installed on the (cold water) fed piping above the top of the water heater and/or storage tank and per the manufacturer's requirements. Vacuum relief valves shall comply with ANSI Z21.22.

2.5 MANUFACTURERS

A. Subject to compliance with requirements, manufacturers offering plumbing equipment shall be limited to the following:

1. Domestic Water Heaters
   Ruud
   Bradford-White
   State
2. Hot Water Circulating Pumps
   Armstrong
   Bell and Gossett
   Taco
   Aurora
   Grundfos
   Amtrol

PART 3 – EXECUTION

3.1 INSTALLATION OF WATER HEATERS

A. Install water heaters where indicated in accordance with manufacturer's installation instructions and in compliance with applicable codes.

B. Set units where indicated, orient so controls and devices needing service and maintenance have adequate access. Level and plumb units. Each unit shall be set on a concrete housekeeping pad.

C. Existing Jan./Laundry Room: Reconnect existing gas hot and cold piping to new unit. Alter piping to suit new connections. Connect recirculating line to unit with check valve and shutoff valve. Extend relief valve discharge to nearest floor drain. Extend and connect new flue exhaust to existing breeching.

D. New Jan./Laundry Room: Connect gas, hot and cold and recirculating piping system and all associated equipment and devices as detailed on the drawing. Flue extension, roof penetration and weatherproof hood shall be by this Contractor.

E. Start-up, test and adjust hot water heaters in accordance with manufacturer's start-up instructions. Check and calibrate controls.

3.2 INSTALLATION OF GAS-FIRED WATER HEATER

A. Furnish and install a complete and operating system. Install water heaters where indicated in accordance with manufacturer’s installation instructions and in compliance with applicable codes. Provide all control wiring for proper operation of the unit.

B. Set unit where indicated, orient so controls and devices needing service and maintenance have adequate access. Level and plumb unit.

C. The unit shall be set on a concrete pad or wall hung for instantaneous type.

D. Start-up, test and adjust hot water heaters in accordance with manufacturer’s start-up instructions. Check and calibrate controls. Start-up shall include the services of the manufacturer’s representative.

E. Combination exhaust vent and air intake shall be included as part of the heater package and extended through the exterior wall and terminate with a grille furnished by the unit manufacturer.

F. Install piping and valving as indicated on piping diagram.

3.3 INSTALLATION OF THERMOSTATIC MIXING VALVE

A. Install mixing valve in accordance with manufacturer's installation instructions and in compliance with applicable codes.

B. At startup of domestic hot water system, mixing valve outlet temperature shall be checked to insure

proper setting and operation. Following adjustments, if required, the mixing valve, if not performing. check if factory required differential temperature in/out with a minimum of Delta "T" is maintained.

C. The temperature of the water delivered by the mixing valve shall be changed by turning the adjusting screw to the right or clockwise for lower temperature; and to the left or counter clockwise for higher temperatures. Maintain a uniform temperature regardless of temperature of incoming water. To facilitate adjustment, a thermometer shall be placed in the line beyond the mixing valve as shown in the diagram and water shall be flowing through the mixing valve while adjustment is being made.

D. Check valves shall be installed on both inlet (hot and cold) to the unit. Include a full size bypass valve arrangement.

E. The hot water return line shall always be piped through the cold water make-up side of the mixing valve.

3.4 INSTALLATION OF HOT WATER CIRCULATING PUMPS

A. Install pumps where indicated, in accordance with manufacturer's published installation instructions, with recommended clearances provided for service and maintenance.

B. Install in-line pumps, supported from piping system, located for access to oil cups, service, and maintenance.

C. Lubricate pumps before start-up. Start-up shall be in accordance with manufacturer's instructions.

D. Install pump unit as detailed on the drawing. Include a check valve and thermometer at the pump unit. The pump shall run on continuous operation. The pump shall be wired into night setback by the ATC system installer.

END OF SECTION

SECTION 22 42 00
COMMERCIAL PLUMBING FIXTURES

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including the Conditions of the Contract (General, Supplementary and other Conditions, if any) and Division 1 as appropriate, apply to the Work specified in this Section.

1.2 DESCRIPTION OF WORK

B. This Section includes:

1. Plumbing fixtures and trim work as indicated by drawings and schedules, and by requirements of this section.
2. Types of plumbing fixtures required for the project include the following:

   Water Closets

   Lavatories

   Urinals

   Countertop Sinks

   Service Sinks

   Showers

   Wash Fountains

   Mop Receptor

   Electric Water Coolers

   Sensor-Operated Flush Valves and Faucets

   Manually Operated Faucets

   Lavatory Shield Enclosure
3. Refer to Section 22 10 00 for domestic water piping systems used in conjunction with plumbing fixtures; not work of this section.
4. Refer to Section 22 13 00 for soil and waste piping systems used in conjunction with plumbing fixtures; not work of this section.
5. Refer to Division 26 sections for electrical connections to water coolers and other plumbing fixtures; not work of this section.

1.3 REFERENCE STANDARDS

A. Refer to Section 22 00 00 for a general description of requirements applying to this section.

1.4 QUALITY ASSURANCE

A. Refer to Section 22 05 00 for a general description of requirements applying to this section.

B. Manufacturers: Firms regularly engaged in manufacture of plumbing fixtures of the type, style and configuration required, whose products have been in satisfactory use in similar service for not less than 3 years.

C. Plumbing Fixture Standards: Comply with applicable portions of International Plumbing Code pertaining to materials and installation of plumbing fixtures.

D. ANSI Standards: Comply with applicable ANSI standards pertaining to plumbing fixtures and systems.

E. ANSI & ADA Standards: Comply with ANSI A171.1 Standard and the ADA Standard pertaining to plumbing fixtures and provisions for handicapped.

1. Water closets shall measure 17" to 19" from the floor to the top of the seat. Bowls shall be elongated type.
2. Flush valve mechanisms shall be on the wide side of the stall, no higher than 44" above the floor.
3. Lavatories shall be mounted no higher than 34" from the floor and provide knee clearance using an offset drain assembly with "P" trap set parallel to the fixture supporting wall. Trap and wall supplies shall be installed for clearance required for the installation of lavatory shield enclosures.
4. Faucets shall be lever operated. See Fixture Schedule. All faucets shall operate on less than 5 pounds force and shall not require tight grasping, pinching or twisting of the wrist.

F. PDI Compliance: Comply with standards established by Plumbing and Drainage Institute pertaining to plumbing fixture supports.

G. Federal Standards: Comply with applicable FS WW-P-541/- Series sections pertaining to plumbing fixtures.

H. UL Labels: Provide water coolers which have been listed and labeled by Underwriters' Laboratories.

I. ARI Labels: Provide water coolers which are rated and certified in accordance with applicable Air-Conditioning and Refrigeration Institute Standards.

1.5 SUBMITTALS

A. Submit shop drawings and product data in accordance with Section 22 00 00.

B. Submit the following:

1. Product Data: Submit manufacturer's specifications for plumbing fixtures and trim, including catalog cut of each fixture type and trim item furnished, roughing-in dimensioned drawings, templates for cutting substrates, fixture carriers, and installation instructions.
2. Color Selection Data: Submit charts or samples for color selection where applicable.
3. Maintenance Data: Submit maintenance data and parts lists for each fixture type and trim item, including instructions for care of finishes. Include this data in maintenance manual.

1.6 WARRANTY/GUARANTEE

A. All work and materials are subject to the general warranty as described in the General Conditions of the Contract and in Division 1, GENERAL REQUIREMENTS.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver plumbing fixtures individually wrapped in factory-fabricated containers.

B. Handle plumbing fixtures carefully to prevent breakage, chipping and scoring the fixture finish. Do not install damaged plumbing fixtures; replace and return damaged units to equipment manufacturer.

PART 2 – PRODUCTS

2.1 PLUMBING FIXTURES

A. Provide factory-fabricated fixtures of type, style and material indicated. For each type fixture, provide fixture manufacturer's standard trim, carrier, seats, and valves as indicated by their published product information; either as designed and constructed, or as recommended by the manufacturer and as required for a complete installation. Where more than one type is indicated, selection is Installer's option; but, all fixtures of same type must be furnished by single manufacturer. Where type is not otherwise indicated, provide fixtures complying with governing regulations.

2.2 MATERIALS

A. Unless otherwise specified, comply with applicable Federal Specification WW-P-541/-Series sections pertaining to plumbing fixtures, fittings, trim, metals and finishes. Comply with the requirements of WW-P-541/-specification relative to quality of ware, glazing, enamel, composition and finish of metals, air gaps, and vacuum breakers, even though some plumbing fixtures specified in this section are not described in WW-P-541/-.

B. Provide materials which have been selected for their surface flatness and smoothness. Exposed surfaces which exhibit pitting, seam marks, roller marks, foundry sand holes, stains, decoloration, or other surface imperfections on finished units are not acceptable.

C. Where fittings, trim and accessories are exposed or semi-exposed, provide bright chrome-plated or polished stainless-steel units. Provide copper or brass where not exposed.

D. Stainless Steel Sheets: ANSI/ASTM A-167, Type 302/304, hardest workable temper. Finish: No. 4, bright, directional polish on exposed surfaces.

E. Steel Sheets for Baked Enamel Finish: ANSI/ASTM A-591, coating Class C, galvanized-bonderized.

F. Steel Sheets for Porcelain Enamel Finish: ANSI/ASTM A-424, commercial quality, Type 1.

G. Vitreous China: High quality, free from fire cracks, spots, blisters, pinholes, and specks; glaze exposed surfaces, and test for crazing resistance in accordance with ANSI/ASTM C-554.

H. Fiberglass: ANSI Z124 smooth surfaced, with color selected by Architect/Engineer.

I. Aluminum: ANSI/ASTM B-209/B-221 sheet, plate and extrusions, as indicated; alloy, temper and finish as determined by manufacturer, except 0.40 mil natural anodized finish on exposed work unless another finish is indicated.

J. Synthetic Stone: High quality free from defects, glaze on exposed surfaces, stain resistant.

2.3 PLUMBING FITTINGS, TRIM AND ACCESSORIES

A. Lavatory Protective Shield Covers:

1. Fully molded enclosure “Lav Shields” as manufactured by Zurn or Truebro, Inc., complete with tamper-resistant stainless steel fasteners.
2. Shield enclosure to meet A.D.A. #4.19.4, ANSI A117.1 and BOCA P- 1203.4.

B. Water Outlets: At locations where water is supplied (by manual, automatic or remote control), provide commercial quality faucets, valves, or dispensing devices, of type and size indicated, and as required to operate as indicated. Include manual shutoff valves and connecting system pipes to permit outlet servicing without shut- down of water supply piping systems.

1. Vacuum Breakers: Provide with flush valves where required by governing regulations, including locations where water outlets are equipped for hose attachment.

C. P-traps: Include removable P-traps where drains are indicated for direct connection to drainage system. All traps shall be minimum 17-gauge.

D. Carriers: Provide cast-iron and/or steel supports for fixtures. Carriers shall be provided for all wall-hung fixtures, and/or the carrier shall be selected to support the fixture independently of the wall. Carriers shall be adjustable type, complete with all fittings and foot supports. Carrier shall be single or double, back-to-back, horizontal offset and vertical stack type. Carrier shall be selected and used as best suited within the pipe chases. Where noted or indicated, stud mount type carriers shall be used and installed within stud wall s 8” and less.

E. Fixture Bolt Caps: Provide manufacturer's standard exposed fixture bolt caps finished to match fixture finish.

F. Escutcheons: Where fixture supplies and drains penetrate walls in exposed locations, provide chrome plated sheet steel escutcheons with friction clips.

G. Aerators: Provide aerators of types approved by Health Departments having jurisdiction.

H. Comply with additional fixture requirements contained in fixture schedule attached to this section.

2.4 FIXTURE LIST

A. Refer to the "Plumbing Fixture & Equipment Schedule" as indicated on the drawings.

2.5 SHOWER – HANDICAP

A. The shower modules shall be manufactured by Best Bath Products, RH/LH and shall be thermoformed from continuous cast acrylic sheet into one piece, seamless units. The units shall be reinforced in the back with fiberglass reinforced polyester resin and have a backside fire rating of "A" and flame spread of 25.

B. Shower modules shall be pre-drilled and equipped with a model Temp Gard III pressure balanced, single dial lever mixing valve with stops, hand held shower head with swivel fitting, 69" flexible stainless steel hose and in-line vacuum breaker, 10 oz. GSA approved shower curtain with curtain hoods, 2" cast brass chrome plated shower drain, and 1" diameter stainless steel curtain rod.

C. All units shall have anti-skid floor treatment to meet performance requirements of ASTM F-462-78. All units are listed under SBCCI Report No. 8556 and BOCA Report No. 86-40.

D. Additional back reinforcements shall be suitably located to provide code complying structural integrity for factory attaching of grab bars, curtain rod, and slide guide for hand held flexible hose shower head.

E. Standard Equipment:

1. Factory Installed:

a. Grab Bars: see table for individual models.

b. Curtain rod: 1" diameter, stainless steel.

c. Shower curtain, 10 oz. with curtain hooks, GSA approved.

d. 2” shower drain, chrome plated, cast brass.

e. Retractable, compact shower seat with stainless steel frame and teakwood seat.

2. Optional Equipment:

a. Model 180AA pressure balanced, single dial lever mixing valve with integral check stops.

b. Hand held shower H-11with swivel fitting, 69" flexible stainless steel hose, and in-line vacuum breaker.

c. Slide guide H-12, 24”

d. Dome light, ATP-1, 60 watt, recessed.

F. Color: Color option is required. Final selection by Architect.

2.6 SENSOR-OPERATED FLUSH VALVES & FAUCETS

A. This Contractor shall furnish and install complete and operating sensor operational faucets and flush valves where so indicated and noted.

B. The Contractor shall have a complete understanding of the sensor operated equipment and system they are installing during the bid phase of the work.

C. The Contractor shall install the system in strict conformance with the manufacturer’s written instructions. The installation shall be executed with good workmanship and to be clear of any interference with the user.

D. All faucet installations shall require a mixing valve for single water supply to faucet.

2.7 AVAILABLE MANUFACTURERS

A. Subject to compliance with requirements, manufacturers offering fixtures, trim and carriers which may be incorporated in the work include, and are limited to the following:

Water Closets (Wall-Mounted Back Outlet – China)

All water closets on this project shall be maximum 1.6 gallons per flush, and shall be of the direct-fed siphon jet action with water control international "WCI" System, ASME A112.19.2M (and 19.6M) for vitreous china fixtures.

Zurn

American Standard

Kohler

China/Enameled Fixtures

Zurn

Delta

Kohler

American Standard

Faucets/Trim (Non-Sensor Operated)

Zurn

Kohler

American Standard

Delta

Moen

Elkay

Speakman

Chicago

Faucets/Trim (Sensor-Operated)

Zurn

Sloan

Speakman

ToTo

Chicago

Flush Valves

Zurn

Sloan "Royal" (optima Series (Sensor-Operated)

Coyne & Delany

ToTo

Wall Supplies/Traps

McGuire

Brass-Craft

Kohler

American Standard
Sanitary-Dash
Teledyne
Wolverine
Pro-Flo
Keeny
Fixture Carriers
Zurn
Josam
Wade
Watts
Smith
MIFAB
Fixture Seats
Zurn
Olsonite
Sperzel
Benke
Bemis
Church
Kohler
American Standard
Centoco
Comfort Seat
Water Coolers
Elkay
Haws
Halsey-Taylor
Oasis
Acorn
Stainless Steel Sinks
Elkay
Just
Dayton
Advanced-Tabco
Shower Assemblies & Systems
Best Bath
Acorn

Symmons

Leonard

Powers

Bradley

Meon

Delta

Shower Units

Best Bath

Fiat

Fibersheen

Kohler

American Standard

Acryline

Aqua-Glass

Aquarius

Aqua-Bath

Comfort Design

Best Bath

Appliance Utility Boxes

PPP, Inc.

Symmons

Guy-Gray

Oatey

B. Cross Reference Identification:

1. If the Contractor selects a manufacturer of drainage equipment products other than as identified on the Schedule but is selected from the available manufacturers listed above, a cover sheet shall be included with the submission of shop drawings indicating the cross-referenced manufacturer and model number.
2. Shop drawings shall not be reviewed or accepted if not in compliance with this requirement.

PART 3 – EXECUTION

3.1 FIXTURE CONNECTIONS

A. Connections to plumbing fixtures shall be of the sizes indicated on the "Plumbing Fixture & Equipment Schedule".

B. The sizes indicated on the Schedule are for drainage and water piping serving an individual fixture; the sizes of the mains and branches shall be as indicated on the drawings.

3.2 FIXTURE SETTING HEIGHTS

A. The plumbing fixtures shall be set in accordance with the heights established by the latest edition of codes and ADA requirements.

Note: Height indicated is established as follows:

Water Closets: From finished floor to top of seat.

Urinals:	From finished floor to rim of fixture.
Lavatories & EWC:	From finished floor to rim of fixture.
Receptor Fitting:	From finished floor to center of fitting.
Shower:	From finished floor to center of shower head.

B. Refer to Architectural drawings and sections for fixture elevations. Fixtures in various areas may be set at lower elevations. Confirm all rough-in elevations prior to any installation.

3.3 LAVATORY PROTECTIVE SHIELD ENCLOSURES

A. Installation shall conform to manufacturer's written instructions.

B. All items involved with wall-hung lavatory installations shall be roughed-in and installed within the enclosure. This includes the offset "P" trap assembly, thermostatic mixing valve, sensor faucet trim and accessories, electrical outlet. Coordinate all work required for complete concealment of all devices.

C. Protective shield enclosures are required on the toilet room's countertop lavatories and are furnished by the Architect. Coordinate all trim and accessories to fit within this enclosure.

3.4 INSPECTION AND PREPARATION

A. Examine roughing-in work of domestic water and waste piping systems to verify actual locations of piping connections prior to installing fixtures. Also examine floors and substrates, and conditions under which fixture work is to be accomplished. Correct any incorrect locations of piping, and other unsatisfactory conditions for installation of plumbing fixtures. Do not proceed with work until satisfactory conditions have been corrected.

B. Install plumbing fixtures of types indicated where shown and at indicated heights; in accordance with fixture manufacturer's written instructions, roughing-in drawings, and with recognized industry practices. Ensure that plumbing fixtures comply with requirements and service intended purposes. Comply with applicable requirements of the International Plumbing Code pertaining to installation of plumbing fixtures.

C. Fasten plumbing fixtures securely to indicated supports or building structure; and ensure that fixtures are level and plumb. Secure plumbing supplies behind or within wall construction so as to be rigid, and not subject to pull or push movement.

3.5 CLEAN AND PROTECT

A. Fixture shall be thoroughly cleaned after completion of installation.

B. Protect installed fixtures from damage during the remainder of the construction period.

3.6 FIELD QUALITY CONTROL

A. Upon completion of installation of plumbing fixtures and after units are water pressurized, test fixtures to demonstrate capability and compliance with requirements. When possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units and proceed with retesting.

B. Inspect each installed unit for damage to finish. If feasible, restore and match finish to original at site; otherwise, remove fixture and replace with new unit. Feasibility and match to be judged by Architect/Engineer. Remove cracked or dented units and replace with new units.

END OF SECTION

SECTION 23 00 00

HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including the Conditions of the Contract (General, Supplementary and other Conditions, if any) and Division 1 as appropriate, apply to work of this Section.

B. This specification or drawing and the design features or resulting construction disclosed, are the property of Furlow Associates, Inc., and shall not be reproduced without written permission.

C. All Mechanical Systems shall be part of and included in all of Division 23 Sections.

1.2 WORK INCLUDED

A. Provide labor, materials, equipment and supervision necessary to install complete operating HVAC Systems, including all work at the site and within the proposed construction areas to accomplish the required work.

B. Wherever the term "provide" is used, it shall be understood to mean both "furnish" and "install".

1.3 REGULATIONS, CODES AND STANDARDS

A. Work shall be performed in accordance with latest adopted codes, regulations and ordinances by authorities having jurisdiction. Observe all safety regulations.

B. Obtain all permits and inspection certificates and pay all charges.

C. Latest editions of any referenced standards shall govern.

1.4 RELATED WORK

A. Refer to equipment shown or specified in sections of Division 1 thru 14 and 26 that will require Mechanical services and provide such service.

B. Refer to work related to HVAC as shown on the following contract drawings:

Architectural & Structural

Plumbing

Electrical

C. This Contractor shall coordinate with the work of Division 26 and the Fire Alarm System vendor for locations and mounting of all duct smoke detectors. These devices are shown on the Mechanical Drawings for reference only to show the intent of the work. All locations shall be determined based on approved shop drawings from the Fire Alarm System vendor and the Contractor for the work of Division 26, Electrical.

1.5 COORDINATION

A. The Mechanical, Plumbing and Electrical Contractors are responsible to coordinate all manufacturer's recommended circuit breakers, starters, disconnects and fuse sizes for all equipment. Submission of a shop drawing will certify that this has been completed. Any necessary changes required will be included as part of this contract.

B. Mechanical Contractor shall coordinate scheduling, submittals and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of independent work elements, with provisions to accommodate items that may be installed at a later time.

C. Mechanical Contractor shall verify utility requirements and all characteristics of operating equipment are compatible with the building utilities. Coordinate the work of all sections related and required for

installing, connection and placing in service of all equipment.

D. Mechanical Contractor shall coordinate all space requirements, supports and installation of all mechanical, electrical, plumbing and fire protection work, which are indicated diagrammatically on the Drawings. Verify routing of all pipes, ducts, conduits and equipment connections. Maximize accessibility for other work, and service requirements for maintenance and repairs. Develop overall coordination drawing (all trades) and submit for review prior to fabrication/installation.

E. Obtain written confirmation from all related trade Contractors and the Owner or his representative that requirements, conflicts and coordination issues have been discussed and resolved.

F. Submit coordination drawings to verify access and clearances.

1.6 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installation within unheated shelters.

1.7 SUBMITTALS

A. Shop Drawings:

1. Shop drawings shall be submitted in accordance with Division 1 of these specifications except where herein modified.

2. Shop drawings comprising complete catalog cuts, performance test data for HVAC equipment as required by other sections of Division 23, shall be submitted for review checking. The Contractor shall review these shop drawings for conformance to contract documents prior to submission and affix contractor's signature to each submittal certifying that this review has been done. By approving and submitting shop drawings, product data, samples and similar materials, the Contractor represents that the Contractor has determined and verified materials, field measurements and field construction data that relates to the work, and has checked and coordinated this information with all of the requirements contained in the contract documents for the work of all trades.

   a. The Contractor and equipment manufacturer shall clearly indentify in all submittals and shop drawings any and all applications standards which require additional work to accommodate this equipment and provide a complete and operational system as described in the contract documents.

   b. The Contractor shall be completely responsible for any and all additional costs associated with the changes required by this and all other trades.

3. Submit a 1/4" scale layout of all mechanical equipment rooms. All equipment and pads shall be to scale of equipment being furnished. Obtain size information of any and all equipment from other trades and indicate on drawings. The drawings shall be fully coordinated with all trades

prior to submission. Indicate coil pull areas, filter pull areas, maintenance clearances, and access as applicable.

4. All shop drawing submittals shall have the following identification data, as applicable, contained therein or permanently adhered thereto.
   a. Project name.
   b. Project number.
   c. Sub-contractor's, vendor's and/or manufacturer's name and address.
   d. Product identification.
   e. Identification of deviation from contract documents.
   f. Applicable contract drawings and specification section number.
   g. Shop drawing title, drawing number, revision number, and date of drawing and revision.
5. Resubmit revised or additional shop drawings as requested.
6. Wherever shop drawings or vendor's standard data sheets indicate work to be done "by others", it shall be the responsibility of the contractor making the submission to identify by name, the contractor who is to do this work. If the contractor named is other than the contractor making the submission, the shop drawing submission must be reviewed by the named contractor and bear his mark of approval, prior to submission to the Architect/Engineer.
7. Where equipment proposed differs from that shown on the drawings or specified, he shall submit for approval drawings showing the manner in which the layout is affected by the substitution.
8. The Contractor shall keep one copy of approved shop drawings at the job site,, filed in a suitable metal container. The shop drawings shall be cataloged and kept in good repair, and shall be available for use by the Owner, Architect and Engineer.
9. No equipment shall be ordered, fabricated, etc., before approval of shop drawings.

B. Contractor is responsible for the shop drawing coordination and interface with the work of other contracts and adjacent work. The relationship of Contractor’s work shall be verified as it relates to adjacent and critical features of the work of this and all contracts and materials.

C. The Contractor shall submit a complete schedule of all shop drawings required for the scope of work covering all materials and equipment listed in all sections of Division 23, Mechanical, including all documents required for contract closeout, Owner instructions and training, and all turnover items at the completion of the work. This schedule shall be submitted for review and approval within thirty days of contract award and before any subsequent materials are provided for review.

D. The shop drawings provided by the Contractor will be reviewed only once and resubmittals will be reviewed only once. Any other submittals will be billed to the Contractor at the Engineer’s standard rates.

1.8 SITE INSPECTION

A. The Contractor shall visit site, inspect, and become aware of all conditions which may effect the work during the estimation phase of his work prior to bid openings. Investigate utilities, protection requirements for adjacent facilities, storage locations, and access to the construction area.

B. Submission of a bid will be deemed evidence of having complied with this requirement.

1.9 SUBSTITUTIONS

A. Whenever a material, article, piece of equipment or system is identified in the following specification or indicated on the drawings by reference to manufacturers' or vendors' names, trade names, catalog numbers or the like, it is so identified for the purpose of establishing the basis of the Bid.

B. Substitution approval must be obtained and included as an addendum item prior to the submission of the bid. An approved substitution shall not be considered as an approval for the Contractor or an equipment vendor to deviate from the written portion of the specifications unless so stated in the addendum.

C. The drawings illustrate the space allocated for equipment and the Contractor shall install the equipment accordingly. If changes are required in the building or arrangement due to substitution of equipment, the Contractor making the substitution must pay for the necessary modifications.

D. The listed equivalent or substituted manufacturers along with the bidding related contractor shall be completely responsible to comply with all requirements on all contract documents. This shall include, but not be limited to all: space requirements, code clearances, type-horsepower-capacities-number and size of services required from other trades including all auxiliary items provided by this Contractor and all other trades, and all manufacturer's specific equipment applications standards and requirements, for approved equipment including that which is basis of design or a substitution. The bidding related contractor and equipment manufacturers shall clearly identify in all submittals and shop drawings any and all applications standards which require additional work to accommodate this equipment and provide a complete and operational system as described in the contract documents. If the bidding contractor or manufacturer does not comply with these requirements then they shall be completely responsible for any and all additional costs associated with the changes required by this and all other trades.

E. Substitutions:

1. Until a date no later than seven (7) days before the date Bids are due, Architect will consider written requests from bidders for substitution of Products. Architect will review requests and will notify Bidders in an Addendum if the requested substitution is acceptable.
2. Submit a separate request for each Product, supported with complete data, with drawings and samples as appropriate, including:
   a. Comparison of the qualities of the proposed substitution with that specified.
   b. Changes required in other elements of the work because of the substitution.
   c. Effect on the construction schedule.
   d. Cost data comparing the proposed substitution with the Product specified.
   e. Any required license fees or royalties.
   f. Availability of maintenance service, and source of replacement materials.
3. Architect shall be the judge of the acceptability of the proposed substitution.
4. A request for a substitution constitutes a representation that Bidder:
   a. Has investigated the proposed Product and determined that it is equal to or superior in all respects to that specified.
   b. Will provide the same warranties or bonds for the substitution as for the Product specified.
   c. Will coordinate the installation of an accepted substitution into the work, and make such other changes as may be required to make the work complete in all respects.
   d. Waives all claims for additional costs, under his responsibility, which may subsequently become apparent.

1.10 LUBRICATION

A. Provide and maintain all required lubrication of any equipment operated prior to acceptance by the Owner. Lubrication shall be as recommended by the equipment manufacturer.

B. Provide one year's supply of lubricants to Owner at date of acceptance.

C. Verify that required lubrication has taken place prior to any equipment start-up.

1.11 EQUIPMENT START-UP

A. Verify proper installation by manufacturer or his representative.

B. Advise General Contractor 2 days prior to actual start-up.

C. Verify proper operation. Obtain signed statement by manufacturer or his representative that equipment is operating within warranty requirements. Submit statement to General Contractor.

D. Perform field mechanical balancing in accordance with Section 23 05 93: TESTING, ADJUSTING, AND BALANCING FOR HVAC.

E. The Mechanical Contractor shall own as part of his work, the following:

Provide one (1) additional drive set, if necessary, to obtain final design balancing requirements. The Mechanical Contractor shall coordinate with Balancing Firm and equipment manufacturer for drive selection, including belts and pulleys.

1.12 OPERATION & MAINTENANCE INSTRUCTIONS

A. Properly and fully instruct Owner's personnel in the operation and maintenance of all systems and equipment.

1. Contractor to demonstrate all systems to Engineer for verification of operation prior to Owner's instruction period.
2. Provide two (2) 4-hour sessions of training to School District/Owner's Maintenance Staff.

B. Insure that the Owner's personnel are familiar with all operations to carry on required activities.

C. Such instruction shall be for each item of equipment and each system as a whole.

D. Provide report that instruction has taken place. Include in the report the equipment and/or systems instructed, date, contractor, Owner's personnel, vendor, and that a complete operating and maintenance manual has been reviewed.

E. Manual shall include all instructions on operation, maintenance, repair parts list, lubrication requirements, brochures, catalogue cuts, complete schedule of air filters for each unit type in Excel spreadsheet format, wiring diagrams, piping diagrams, control sequences, service requirements, names and addresses of vendors, suppliers and emergency contacts. Three manuals shall be provided.

F. Submit manuals for review prior to operating instruction period. Manuals shall be 8-1/2 x 11" with hard cover, suitably bound.

G. Provide to the Owner any special tools necessary for operation and routine maintenance of any of the equipment.

H. Upon completion of the project, the Mechanical Contractor shall provide a complete set of legible as-built drawings for the Owner.

I. Furnish three (3) copies of a professionally taped video and three (3) copies of professionally prepared drawings demonstrating the following:

- Locations of main shut-off valves.
- Procedures for equipment start-up and seasonal shut-downs.
- Procedures for maintenance.
- Provide written version of all procedures included in video.

The above should cover all equipment/systems including, but not limited to, the following:

- Air handlers
- Energy recovery unit

- Fans
- D/X cooling units
- ATC System

1.13 TOOLS

A. All equipment furnished by the Mechanical Contractor which requires special tools or devices other than those normally available to the maintenance or operating staff shall be furnished in duplicate to the Owner, sufficiently marked, packed or boxed for staff usage. The tools provided shall be listed by the Mechanical Contractor identified as to their use or the equipment applicable in a written transmittal to the Owner.

1.14 CLEANING AND FINISHING

A. After equipment start-up and all operating tests have been made and the system pronounced satisfactory, each respective Contractor shall go over the entire project, clean all equipment, etc., installed by him and leave in a clean and working condition. Any surfaces found marred after this final cleaning shall be refinished or replaced by each Contractor at no cost to the Owner.

B. Provide for the safety and good condition of all materials and equipment until final acceptance by the Owner. Protect all materials and equipment from damage. Provide adequate and proper storage facilities during the progress of the work. Special care shall be taken to provide protection for bearings, open connections, pipe coils, pumps, compressors and similar equipment.

C. All fixtures, piping, finished surfaces and equipment shall have all grease, adhesive labels and foreign materials removed.

D. All piping shall be drained and flushed to remove grease and foreign matter. Pressure regulating assemblies, traps, and similar items shall be thoroughly cleaned. Remove and thoroughly clean and reinstall all liquid strainer screens after the system has been in operation ten (10) days.

E. When connections are made to existing systems, the Mechanical Contractor shall do all cleaning and purging of the existing systems required to restore them to the condition existing prior to the start of work.

F. Clean-up: Remove from the premises, all unused material and debris resulting from the performance of work under this section.

1.15 TEMPORARY USE OF EQUIPMENT

A. The use of permanent equipment and terminal units during the construction period shall be done at the specific direction of the Construction Manager or the Owner’s Representative, and as permitted by Local Code.

B. Whenever equipment has been used as directed, the Mechanical Contractor shall change unit filters as required in other sections of Division 23, as well as vacuum clean the interior of all unit enclosures to a like-new condition, including cleaning of coils. Under no circumstances will energy recovery equipment be used for temporary purposes.

C. Mechanical Contractor shall also vacuum clean the interior of all connecting ductwork, fittings, dampers, air outlets and inlets.

D. Mechanical Contractor shall also provide the Owner with a full and complete warranty required in other sections of Division 23 and the General Conditions of the contract.

PART 2 – PRODUCTS

2.1 GENERAL

A. All material and equipment shall be new and of present day manufacture, and shall conform to accepted standards of the trade where such a standard has been established for the particular type of equipment or material.

B. Whenever equipment or material is referred to in the singular, such as "the fan", it shall be deemed to apply to as many such items as necessary to complete the work.

2.2 PRODUCT DELIVERY, STORAGE AND HANDLING

A. During loading, transporting and unloading exercise care to prevent damage to material.

B. Store all materials in dry enclosures or under protective coverings out of way of work progress.

C. Material shall not be allowed to be stored directly on ground.

D. Deliver in manufacturer's original cartons or on skids.

E. Handle and protect so as to prevent damage to product or any surrounding material.

2.3 WARRANTY

A. Wherever in the specification sections of this division, reference is made to a specific warranty period, this warranty shall be in addition to and not a limitation of other rights the Owner may have against the Mechanical Contractor under the contract documents.

PART 3 – EXECUTION

3.1 PROTECTION

A. Plug or cap open ends of piping systems, conduit and ductwork.

B. Stored materials shall be covered to prevent damage by inclement weather, sun, dust or moisture.

C. Protect all installed work until accepted in place by the Owner.

D. Plates, polished metal escutcheons, thermostats and other finished devices shall not be installed until masonry, tile, and painting operations are complete unless otherwise protected.

E. Protect all work from operations which may cause damage such as hauling, welding, soldering, painting, insulating and covering.

3.2 WORKMANSHIP

A. Install all work neat, trim and plumb with building lines.

B. Install work in spaces allocated.

C. Cutting and patching shall be performed by skilled tradesmen normally employed for the work involved.

D. This Contractor shall provide a complete weathertight seal to all new systems in the building including the necessary caulking, weather-stripping and insulation.

3.3 EQUIPMENT SETTING

A. Provide as a minimum, a 4 inch concrete pad beneath all floor-mounted equipment. Install anchor bolts in pour.

B. Provide as a minimum, spring vibration isolation under any equipment 10 HP and over and rubber in shear vibration isolation on any equipment up to 10 HP. For further specifications and additional requirements, refer to other sections.

C. Concrete shall be 3,000 psi, 28 day compressive strength in accordance with ACI-613. Reinforce with No. 4 rod 12" on centers both ways or as otherwise detailed.

3.4 FASTENERS, HANGERS AND SUPPORTS

A. Provide all hangers and supports required to suspend, mount, or hang the work.

B. Provide all miscellaneous steel angles, channels, beams, clips, brackets and anchors necessary to hang or support the work. Provide submissions for review.

C. Install concrete inserts before concrete is poured.

D. Drilled inserts shall not be loaded more than 1/4 rated capacity.

E. Power-driven fasteners shall not be allowed for piping larger than 2 inch, or equipment. When used they shall not be loaded more than 1/8 rated capacity or 200 pounds.

F. All hangers, miscellaneous steel, braces and supports shall be galvanized, cadmium plated, or primed steel. Copper tubing shall be supported with copper hangers.

G. Piping shall be supported from adjustable clevis type hangers with insulation pipe saddles or pipe shields in accordance with piping support spacing table on the drawings. Where hangers are 18" or longer provide lateral bracing at every fourth hanger.

H. Support vertical piping at floor levels. Piping shall have split rings.

I. Any lintels required for openings for this work if not indicated on Architectural or Structural drawings shall be provided under this Section.

3.5 SLEEVES

A. Provide each pipe, duct or conduit passing through a masonry or concrete wall, floor or partition with a sleeve made from standard weight steel pipe for pipe or conduit and No. 12 gauge galvanized steel for ducts, with smooth edges, securely and neatly cemented in place. Provide each pipe, duct or conduit passing through a frame or metal partition with a sleeve made from No. 22 gauge galvanized sheet metal, securely fastened in place.

B. Be responsible for the proper location and alignment of all sleeves.

C. Provide hydrostatic seals for sleeves passing through outside walls, either above or below grade, or through hydrostatically sealed slabs or floors on grade. Provide fire-rated seals for all sleeves which penetrate fire-rated walls.

D. Install both piping and sleeve seals so as to maintain integrity of seals with expansion and contraction of piping.

E. Set floor sleeves flush with floor surface in finished areas, 1" above the finished floor in kitchens, cafeterias, and similar service areas unless such areas are slab-on-grade; 1" above the floor in mechanical rooms, pipe chases, pipe spaces and other unfinished areas, unless otherwise indicated, and flush with the underside of slabs. Extend wall and partition sleeves through and cut flush with each surface unless otherwise indicated or specified.

F. Select sleeves two pipe sizes larger than any pipe or conduit that is to remain uncovered, unless otherwise required by the sealing method specified. Where pipes are to be covered, provide sleeves large enough to allow the covering to pass through the sleeves with sufficient clearance for sealing as specified hereinafter. Size sleeves for branch piping from vertical risers large enough to permit vertical expansion at the riser.

G. Select duct sleeve sizes to suit requirements of fire dampers and sealing methods as specified.

H. Place sleeves imbedded in concrete floors or walls in the forms before concrete is poured; sleeves shall have integral waterstop flanges, where they are to receive either watertight or hydrostatic seals.

I. Install sleeves passing through above-grade floors of mechanical rooms, toilet rooms, kitchens or similar service areas where liquid leaks or spillover may occur in a watertight manner. Sleeves shall be such that waterproofing membrane can be flashed around and into the sleeve where necessary.

J. Seal sleeves for pipes or conduit passing through ceiling, walls, in a manner similar to that specified for fire-rated sleeves.

K. Hydrostatic Sealing Method: Provide compressible synthetic rubber seals, equivalent to LINK SEAL, manufactured by the Thunderline Corporation, or THRUWALL manufactured by O.Z. Gedney. Install seals in accordance with the manufacturer's recommendations to provide air tightness aboveground and hydrostatic sealing belowgrade. Caulking or other type mastic is not acceptable.

L. Fire-Rated Sealing Method:

1. Sleeves, openings and sealants shall comply with applicable codes, recommended practices and standards, and manufacturer's instructions. Fire sealants shall have ability to prevent spread of flame, smoke or water throughout the penetration and shall pass 3-hour test, UL test ASTM E814 and UL 1479.

2. Products: Chase Corporation CTC PR-855, O. Z. Gedney CRS/CAFS, 3M Electro-Products Division Putty 303 or Caulk CP25 penetration sealing kits, General Electric Company sealants type RTV-850, 6428 or 7403, Hilti FS-one, Thunderline Corporation "Link-Seal Pyro-Pak". Installation and type of sealant to be used as recommended by the manufacturer.

3.6 PLATES

A. Provide chrome plated plates wherever piping passes into finished area.

B. Plates shall be securely fastened to piping or building construction.

C. Floor plates shall cover 1 inch sleeve extension.

3.7 OFFSETS, TRANSITIONS, MODIFICATIONS

A. Provide all offsets necessary to install the work and to provide clearance for other trades.

B. Maintain adequate headroom and clearance.

C. Incidental modifications necessary to the installation of the systems shall be made as necessary and as approved by the Architect.

3.8 RECESSES

A. Furnish information to the General Contractor as to sizes and locations of recesses required to install panels, boxes, and other equipment or devices which are to be recessed in walls.

B. Make offsets or modifications as required to suit final locations.

3.9 LABELING

A. All HVAC equipment such as pumps, fans, air handling units, and devices requiring identification for operating procedures shall be provided with permanent black laminated micarta white core labels with 3/8 inch letters.

B. This shall also apply to all controllers, remote start/stop pushbuttons and equipment cabinets.

C. This shall not apply to individual room thermostats.

D. All Mechanical Rooms shall be identified with a permanent placard of red-white-red laminated, commercial grade, plastic construction. Letters shall be minimum one inch high and read in capital letters: WARNING – MECHANICAL EQUIPMENT ROOM – LIMITED ACCESS. Placard shall be centered on each door leading into the mechanical room at five feet above the floor and attached at each corner with brass screws.

E. Refrigeration Machinery Rooms shall be identified with a permanent placard of red-white-red laminated, commercial grade, plastic construction. Letters shall be minimum one inch high for the header to read in capital letters: WARNING – REFRIGERATION EQUIPMENT ROOM – LIMITED

ACCESS. The following information shall be posted in a similar fashion, minimum half-inch high capital letters, indicating:

1. The name and address of the installer.
2. The refrigerant number and amount of refrigerant in pounds.
3. The lubricant identity and amount in pounds or ounces as appropriate.
4. The field test pressure applied to the equipment in psig.

Placard shall be centered on each door leading into the refrigeration equipment room at five feet above the floor and attached at each corner with brass screws.

F. At all fire damper, smoke damper and combination fire/smoke damper locations, access doors in ductwork shall be identified with a permanent placard of red-white-red laminated commercial grade plastic construction, minimum one-half inch high capital letters, reading, “FIRE DAMPER”, “SMOKE DAMPER”, “FIRE/SMOKE DAMPER” as appropriate for the installation. Attach securely to face of access door with brass screws at each corner, sealed airtight.

3.10 FLASHING AND COUNTERFLASHING

A. Roof curbs, etc., shall have counterflashing fittings. General Contractor shall provide flashing.

B. Piping and conduit thru the roof shall be flashed by the General Contractor. Provide counterflashing.

C. Provide curbs with base features required to match roof materials, finishes and configuration; e.g., flat, sloped, raised seam, etc.

3.11 ACCESS

A. Locate all equipment, valves, devices and controllers which may need service in accessible places.

B. Where access is not available, access panels shall be provided. Furnish access panels to the General Contractor for installation.

C. Access panels shall be Nailor-Hart Industries, Karp Co., or Controlled Air Manufacturing Limited, with 16 gauge frames and 14 gauge steel door, prime painted.

D. Maintain access clearances for tube or fan removal, coil pulls, and filter removal.

3.12 WIRING AND MOTOR CONTROLS

A. Packaged equipment shall be furnished with disconnect switches, starters, overloads, factory furnished and wired by the unit manufacturer.

B. Roof-mounted exhaust fans, except utility sets, rated less than 1/2 HP at 115 volts, single phase, shall be furnished with disconnect switches, factory furnished and wired by unit manufacturer.

C. Rooftop equipment shall be furnished with starters, disconnect switches, overloads, factory furnished and wired by unit manufacturer.

D. This Contractor shall furnish all information and assistance required for the Electrical Contractor to purchase all motor starters that are not specified to be part of the mechanical equipment.

E. Control wiring shall be provided under this Division of the work.

F. All wiring shall be in accordance with the National Electrical Code and as recommended by the equipment manufacturer.

3.13 UTILITIE

A. Do not interrupt any utility or service to the Owner without adequate previous notice and schedule.

3.14 OPENINGS - CUTTING, REPAIRING

A. This Contractor shall cooperate with the work to be done under other sections in providing information as to openings required in walls, slabs and footings for all piping, ductwork and equipment, including sleeves where required.

B. Any drilling or cutting required for the performance of work under this Section, shall be the responsibility of this Contractor and the cost thereof shall be borne by him.

C. Holes in Concrete: Sleeves shall be furnished, accurately located and installed in forms before pouring of concrete. This Contractor shall pay all additional costs for cutting of holes as the result of the incorrect location of sleeves. All holes through existing concrete shall be either core drilled or saw cut. All holes required shall have the approval of the Structural Engineer prior to cutting or drilling.

D. It shall be the responsibility of this Contractor to ascertain that all chases and openings are properly located.

3.15 PAINTING

A. This Contractor shall be responsible for painting required in conjunction with cutting and patching of existing building construction, in areas which are not scheduled for painting under the General Contract. This Contractor shall also be responsible for painting existing equipment, and/or piping, where finish is damaged by new work, in these same areas.

B. Refer to Division 1 for types of paint, color and finish.

C. Surfaces subjected to temperatures below 180 degrees F, shall be painted with one coat of rust-resisting paint and one coat of high gloss enamel or sufficient finish coats for complete and uniform cover and high glossy finish.

D. Surfaces subjected to temperatures above 180 deg. F, shall be painted with one coat of heat-resistant paint and one coat of heat resistant enamel, or sufficient finish coats for complete and uniform cover and high glossy finish.

E. All painting shall be done in a careful, neat and workmanlike manner, with particular care being exercised to protect adjacent building and equipment finishes. All surfaces shall be thoroughly cleaned of dirt, rust, scale, dust, grease, oil, debris and sanded, sand blasted or power brushed to properly prepare to provide bond for the paint. Contractor shall be entirely responsible for cleaning and preparing all surfaces. Should evidence appear that the surface was not properly prepared, the Contractor shall remove paint, prepare surface and repaint, as required, at no additional cost.

F. All name plates, data plates that indicate manufacturer, model, size, capacity codes or identifying data on equipment painted, shall not be painted, but shall be carefully cut in.

G. All exposed canvas, insulation jackets and other porous surfaces shall be cleaned and sized with at least two coats of sizing primer before finish coats are applied. Sizing shall completely cover canvas so that canvas will not be noticeable through the final finish coat.

H. Equipment factory painted and not damaged shall not be painted, except equipment herein specified to be painted a particular color. Damaged surfaces on factory painted equipment will necessitate the painting by this Contractor.

I. Grilles, access panels, fan screen, convector, and unit heater enclosures and other prime-coated equipment in finished areas, will be painted by the General Contractor.

J. Piping, fans, floor-mounted pipe supports, containers, hangers, pump and other equipment surfaces that are insulated or uninsulated shall be finished in accordance with the Owner's color code.

K. The Mechanical Contractor shall furnish and lay drop clothes in all areas where painters finish work is being done, to protect floors and roofs and all other work from defacement. All temporary protections

or coverings removed too early from any part of the work shall be promptly replaced, and any damage from neglect to do so shall be made good at the Mechanical Contractor's expense.

L. At the end of each day, the Mechanical Contractor shall place in covered metal containers, or destroy, all cloths, waste and refuse, which have been used in the application of inflammable paint materials. At the completion of work, all staging, scaffolding, containers and debris shall be removed from premises, leaving all painting in perfect and clean condition. Upon completion, leave the work clean and free from blemishes. Hardware, tile, marble, and similar material shall be thoroughly cleaned of all paint.

3.16 GUARANTEE

A. All work shall be guaranteed to be free from defects for a period of one year of operation from date of acceptance by the Owner.

B. Guarantee shall be extended on an equal time basis for all non-operational periods due to failure within the guarantee period.

C. All materials and equipment provided and/or installed under this section of the specifications shall be guaranteed for a period of one year from date of acceptance of the work by the Owner unless otherwise specified in Division 1. Should any trouble develop during this period due to defective materials or faulty workmanship, the Mechanical Contractor shall furnish necessary labor and materials to correct the trouble without any cost to the Owner. Any defective materials or inferior workmanship noticed at time of installation and/or during the guarantee period shall be corrected immediately to the entire satisfaction of the Owner.

D. In the event of occupancy by the Owner prior to final acceptance of the project, the guarantee date for equipment placed in operation shall be mutually agreed to by the Mechanical Contractor and the Owner's representative.

E. Contractor to include an 11 month “walk-thru” of the building systems with representatives of the School District, Architect, Engineer and the Construction Manager. The purpose is to establish a list of corrective work that relates to operational issues, material/installation deficiencies, etc. prior to the expiration of the guarantee period.

3.17 DRAWINGS

A. The Mechanical Systems are indicated on the Contract Drawings. Certain pertinent information and details required by the Mechanical Work appear on the Architectural, Structural and Electrical Drawings; become familiar with all drawings, and incorporate all pertinent requirements.

B. Drawings are diagrammatic and indicate the general arrangement of systems and requirements of the work. Do not scale drawings. Exact locations of fixtures and equipment, not specifically shown, shall be obtained before starting work.

3.18 TESTING AND BALANCING OF MECHANICAL EQUIPMENT

A. Perform field mechanical balancing in accordance with Section 23 05 93: TESTING, ADJUSTING, AND BALANCING FOR HVAC.

B. The Mechanical Contractor shall own as part of his work, the following:

Provide one (1) additional drive set, if necessary, to obtain final design balancing requirements. The Mechanical Contractor shall coordinate with Balancing Firm and equipment manufacturer for drive selection, including belts and pulleys.

END OF SECTION

SECTION 23 05 00
COMMON WORK RESULTS FOR HVAC

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including the Conditions of the Contract (General, Supplementary and other conditions, if any) and Division 1 as appropriate, apply to the work specified in this section.

B. Refer to Section 23 00 00 for HVAC General Provisions.

C. Refer to other sections in Division 23 for materials and methods not specified herein.

1.2 DESCRIPTION OF WORK

A. Included in this Section are the following:

1. Steel Pipe and Fittings
2. Copper Tubing & Fittings
3. Strainers
4. Thermometers
5. Gauges
6. Test Stations - Pressure/Temperature
7. Isolating Fittings
8. Unions
9. Motors

1.3 REFERENCE STANDARDS

A. Refer to Section 230200 for a general description of requirements applying to this section.

B. Install work to meet the requirements of the following:

1. _____Dept. of License and Inspections
2. International Mechanical Code
3. Gas Utility Company
4. NFPA
5. OSHA
6. ASHRAE
7. Manufacturer’s Standardization Society (MSS) of the valve and Fittings Industry, Inc.:

SP-58 Pipe Hangers and Supports Materials, Design and Manufacture.

SP-69 Pipe Hangers and Supports Selection and Application

C. Appliances and materials governed by UL requirements shall meet such requirements and bear the label.

1.4 QUALITY ASSURANCE

A. Provide adequate supervision of labor force to assure that all aspects of the specifications are being fulfilled.

B. Verify that all work and equipment is installed in accordance with manufacturer's warranty requirements.

PART 2 – PRODUCTS

2.1 STEEL PIPE AND FITTINGS

A. Water Piping:

1. ASTM A53 seamless, Schedule 40.
2. Fittings up to 2 inch shall be 150 lb. malleable iron, screwed pattern ASME B16.3. Butt weld , ASME B16.9, same thickness as pipe.
3. Fittings 2-1/2" and larger shall be butt weld ASME B16.9, same thickness as pipe.
4. Weld-O-Lets and Thread-O-Lets shall be maximum of two sizes smaller than main size; i.e., maximum of a 2-inch Weld-O-Let on a 3-inch pipe.
5. Thread tape shall be teflon tape, 3 mils minimum thickness.

B. Low Pressure Steam Piping: (15 PSIG and Below):

1. ASTM A-53 seamless, Schedule 40.
2. Fittings 2" and Smaller: 300 lb. malleable iron, threaded, ASTM designation A47, ASME B16.3. 300 lb. malleable threaded fittings shall be used for screwed connection and disassembly.
3. Fittings 2-1/2" and Larger: Butt weld, ASME B16.9, Grade WPB, same thickness as pipe.

C. High Pressure Steam Piping: (16 to 150 psig):

1. ASTM A53 seamless, Schedule 80.
2. Fittings: ASME B16.3 malleable iron Class 250, or ASTM A234 forged steel welding type, Class 300.
3. Joints: Threaded for pipe 2 inch and smaller; welded for pipe 2-1/2 inches and larger.

D. Steam Condensate Return Piping:

1. ASTM A-53 seamless, Schedule 80.
2. Fittings 2" and Smaller shall be per ASME B16.3 for pressure rating of system.
3. Fittings 2-1/2" and Larger: Butt-weld, ASME B16.9, Grade 1, same thickness and material as adjoining pipe.

E. Fuel Oil Piping:

1. ASTM A53 seamless, Schedule 40.
2. Fittings up to 2 inches shall be 150 lb. malleable iron, screwed pattern ASME B16.3.
3. Do not use Teflon tape.
4. All joints above ceilings shall be fillet welded.

2.2 COPPER TUBING & FITTINGS

A. Refrigeration Piping:

1. Copper tubing: Type ACR, hard drawn temper.
2. Fitting: Wrought-copper, solder joints, ASME B16.22 or ASME B16.26.
3. Joints: Brazed, American Welding Society (AWS) Class BCUP-5 for brazing filler metal.

B. Condensate Drain Piping:

1. Pipe: Copper tubing Type DWV.
2. Fittings: Wrought copper solder type drainage fittings, ASME B16.23 or B16.29.

2.3 MOTORS

A. All single phase and polyphase motors shall be manufactured to incorporate the latest NEMA standards.

B. All single phase and polyphase motors shall have steel frames with ball bearings and copper windings. All motors to have a Class "F" insulation system with a service factor of 1.15.

C. All motors shall be 1725 RPM, 4 pole design, unless otherwise noted on the drawings, or in the equipment specifications.

D. Motors installed indoors and not exposed to moisture shall be open, dripproof, Class B temperature rise based on 40 deg. C maximum ambient temperature.

E. Motors installed outdoors and exposed to moisture shall be totally enclosed, fan cooled, Class B temperature rise based on 40 deg. C maximum ambient temperature.

F. Based on NEMA Standards, motors shall comply with the following minimum nominal efficiencies at full load.

Nominal Efficiencies for "NEMA Premium ™" Induction Motors Rated 600 Volts or Less (Random Wound)						
	Open Drip-Proof			**Totally Enclosed Fan-Cooled**		
HP	**3500 RPM**	**1800 RPM**	**1200 RPM**	**3500 RPM**	**1800 RPM**	**1200 RPM**
1	**82.5**	**85.5**	**77.0**	**82.5**	**85.5**	**77.0**
1.5	**86.5**	**86.5**	**84.0**	**87.5**	**86.5**	**84.0**
2	**87.5**	**86.5**	**85.5**	**88.5**	**86.5**	**85.5**
3	**88.5**	**89.5**	**85.5**	**89.5**	**89.5**	**86.5**
5	**89.5**	**89.5**	**86.5**	**89.5**	**89.5**	**88.5**
7.5	**90.2**	**91.0**	**88.5**	**91.0**	**91.7**	**89.5**
10	**91.7**	**91.7**	**89.5**	**91.0**	**91.7**	**90.2**
15	**91.7**	**93.0**	**90.2**	**91.7**	**92.4**	**91.0**
20	**92.4**	**93.0**	**91.0**	**91.7**	**93.0**	**91.0**
25	**93.0**	**93.6**	**91.7**	**93.0**	**93.6**	**91.7**
30	**93.6**	**94.1**	**91.7**	**93.0**	**93.6**	**91.7**
40	**94.1**	**94.1**	**92.4**	**94.1**	**94.1**	**92.4**
50	**94.1**	**94.5**	**93.0**	**94.1**	**94.5**	**93.0**
60	**94.5**	**95.0**	**93.6**	**94.5**	**95.0**	**93.6**
75	**94.5**	**95.0**	**93.6**	**94.5**	**95.4**	**93.6**
100	**95.0**	**95.4**	**93.6**	**95.0**	**95.4**	**93.6**
125	**95.4**	**95.4**	**94.1**	**95.0**	**95.4**	**94.1**
150	**95.4**	**95.8**	**94.1**	**95.8**	**95.8**	**95.0**
200	**95.4**	**95.8**	**94.1**	**95.8**	**96.2**	**95.0**

G. All motors rated less than 1/2HP shall have thermal protection of the auto-reset type as an integral part of the motor.

H. All motors rated 1/2HP and larger shall have thermal protection provided by an external device.

I. Whenever a variable frequency PWM drive is installed to control an AC motor, a maintenance-free, circumferential, conductive micro fiber shaft grounding ring shall be installed on the AC motor drive

end to discharge shaft currents to ground. Recommended part: AEGIS SGR™ Bearing Protection Ring, as made by Electro Static Technology. Install in accordance with the manufacturer's written instructions.

PART 3 – EXECUTION

3.1 TAGS, CHARTS AND IDENTIFICATION

A. Painting of Ductwork:

Provide painting for all exposed ductwork in Mechanical Rooms and in all finished spaces. Prime and paint two coats with the proper metal primer for the material and two coats of a flat or semi-gloss metal protective paint.

3.2 WELDING

A. All concealed and inaccessible black steel piping shall be welded.

B. All black steel piping larger than 1-1/4 inch may be fusion welded.

C. All elbows, tees and branch connections shall be made with welding fittings ANSI B16.9.

D. Welding shall be in accordance with the ASME Boiler and Pressure Vessel Code Section IX.

E. Furnish welder test certificate for review. Certificates of successful qualification by the following organizations shall be acceptable.

1. ASME Boiler and Pressure Vessel Code
2. ANSI Code for Pressure Piping
3. National Certified Pipe Welding Bureau
4. Military Specification MIL-STD-248

E. WELDING

1. All welding shall be performed in accordance with these code sections:
   a. ASNE Boiler and Pressure Vessel Code
   b. ANSI Code for Pressure Piping
2. Successful contractor shall be responsible for **all costs** associated with the testing of all welders, including all equipment, materials and labor to certify welders for all welding applications, and quality control personnel.
3. All welders shall be employees of the successful contractor. No subcontractors allowed.
4. Any welder who fails initial test will not be able to retest for 60-days.
5. All welding tests will be taken on Colonial School District facilities, location to be named later.
6. An independent testing company will witness welding tests for each welder and also x-ray weld coupons after weld has been completed. A designated School District representative shall also be notified prior to testing so he has appropriate time to witness testing of welders.
7. Testing procedure and other occurring expenses shall be at the contractor's expense.
8. Contractor shall provide appropriate paperwork, Welder/Welding Operator Performance Qualifications (WPQ) (See attached form), to testing company at time of welding test.
9. Contractor is required to stamp all welds in the field and the shop with each individual welder's identifying stamp.
10. Owner has the option to x-ray all welds on project, including any offsite fabrication.

11. Any welder having two failed x-ray welds, which have to be repaired or cut out, will not be allowed to weld on the remainder of the project/projects.
12. Any welds found to be unacceptable by x-ray shall be repaired by contractor at the contractor's expense.
13. Contractor will pay for initial x-ray and a follow-up x-ray after any weld that has been repaired or deemed rejected.

    SMAW - Stick Wire

    Test – 6" sch. #40 – 6G – A-105 & A-106 Carbon Steel

    5P – Root Pass

    7018 – Filler Passes & Cap

    GMAW – Mig.

    Test – 6" sch. #40 – 6G - A-105 & A-106 Carbon Steel

    (Same type of wire for Root Pass and Filler Passes & Cap, as shown above for SMAW)

    Structural Steel – AWS D1.1

    Furnish welder test certificate for review. Certificates of successful; qualifications by the following organization shall be acceptable:

    - ASME Boiler & Pressure Vessel Code-ASME Sec. IX Welder Qualification
    - ANSI Code for Pressure Piping – ASME B31.3 NFS for Production Welds

END OF SECTION

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SECTION 23 05 23

GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including the Conditions of the Contract (General, Supplementary and other conditions, if any) and Division 1 as appropriate, apply to the work specified in this section.

B. Refer to Section 23 00 00 for HVAC General Provisions.

C. Refer to other sections in Division 23 for materials and methods not specified herein.

1.2 DESCRIPTION OF WORK

A. This Section includes the following:

1. General
2. Refrigerant Valves and Specialties

1.3 QUALITY ASSURANCE

A. Provide adequate supervision of labor force to assure that all aspects of the specifications are being fulfilled.

B. Verify that all work and equipment is installed in accordance with manufacturer's warranty requirements.

PART 2 – PRODUCTS

2.1 GENERAL

A. All gate and globe valves shall be designed for repacking under pressure when fully opened, and shall be equipped with packing suitable for the intended service. When the valve is fully opened, the back seat shall protect the packing and the stem threads from the fluid. All gate and globe valves shall have a gland follower. The pressure- temperature rating of valves shall be not less than the design criteria applicable to all components of the system.

B. Insofar as possible, all valves of the same type shall be of the same manufacture.

C. Valves installed above 7 ft. in Mechanical Rooms shall have chain operators.

D. All valves shall be provided with stem extensions. Valve handle shall be clear of insulation jacket.

E. Manufacturers:

Stockham

Milwaukee

Hammond

Apollo

Watts

Walworth

Nibco

Jamesbury

2.2 REFRIGERANT VALVES & SPECIALTIES

A. Service Valves:

1. Globe Shutoff Valves: Forged brass, packed, back seating, winged seal cap, 300 degrees F (149

degrees C) temperature rating, 500 psi working pressure.

2. Check Valves: Forged brass, accessible internal parts, soft synthetic seat, fully guided brass piston and stainless steel spring, 250 degrees F (121 degrees C) temperature rating, 500 psi working pressure.
3. Manufacturers:

   Henry Valve Co.

   Parker Hannifin Corp., Refrigeration & Air-Conditioning

   Sporlan Valve Co.

B. Solenoid Valves:

1. 2-way Solenoid Valves: Forged brass, designed to conform to ARI 760, normally closed, teflon valve seat, NEMA 1 solenoid enclosure, 24-volt, 60 Hz., UL-listed, 1/2" conduit adapter, 250 degrees F (121 degrees C) temperature rating, 400 psi working pressure.
2. Manufacturers:

   Alco Controls Div., Emerson Electric Co.

   Automatic Switch Co.

   Sporland Valve Co.

C. Specialties:

1. Refrigerant Strainers: Brass shell and end connections, brazed joints, monel screen, 100 mesh, UL listed, 350 psi working pressure.
2. Moisture-Liquid Indicators: Forged brass, single port, removable cap, polished optical glass, solder connections, UL listed, 200 degrees F (93 degrees C) temperature rating, 500 psi working pressure.
3. Refrigerant Filter-Driers: Corrosion-resistant steel shell, steel flange ring and spring, wrought copper fittings, ductile iron cover plate with steel cap screws, replaceable filter-drier core, 500 psi working pressure.
4. Evaporator Pressure Regulators: Provide corrosion-resistant, spring loaded, stainless steel springs, pressure operated, evaporator pressure regulator, in size and working pressure indicated, with copper connections.
5. Refrigerant Discharge Line Mufflers: Provide discharge line mufflers as recommended by equipment manufacturer for use in service indicated, UL listed.
6. Manufacturers:

   Alco Controls Div., Emerson Electric Co.

   Henry Valve Co.

   Parker-Hannifin corp., Refrigeration & Air Conditioning Div.

   Sporlan Valve Co.

PART 3 – EXECUTION

3.1 PIPING SYSTEMS

A. All piping to drain to low points. Low points shall be provided with drain valves with hose thread.

B. Valve body construction shall match piping system material.

C. Install isolating fittings between sections of ferrous and non-ferrous pipe or connected equipment.

D. Valves shall be installed with stems above horizontal.

E. Valves shall be installed on all sides of equipment and control valves to allow isolation for repair.

F. Unions shall be provided adjacent to all valves, at equipment connections, and where necessary to facilitate dismantling of the piping system.

3.2 TAGS, CHARTS AND IDENTIFICATION

A. Identify each valve in all systems in accordance with requirements of Section 23 05 00.

END OF SECTION

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SECTION 23 05 48

VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the contract, including the conditions of the contract (General, Supplementary and other Conditions, if any) and Division 1 as appropriate, apply to the work specified in this section.

B. Refer to Section 23 00 00 for HVAC General Provisions

C. Refer to Section 23 05 00 for Common Work Results for HVAC.

1.2 DESCRIPTION OF WORK

A. This Section includes providing the following vibration and sound isolation material on items furnished and installed under HVAC work:

1. Pump-mounted inertia pads
2. Piping, Inline Pumps
3. Fans and AHU's
4. Suspended Fans, H&V Units
5. Rooftop AHU's
6. Cooling towers
7. Ductwork and equipment

1.3 REFERENCE STANDARDS

A. Refer to Section 23 00 00 for a general description of requirements applying to this section.

1.4 QUALITY ASSURANCE

A. Refer to Section 23 05 00 for a general description of requirements applying to this section.

1.5 SUBMITTALS

A. Submit shop drawings, installation instructions, and manufacturer's literature of all materials specified in accordance with Section 23 00 00.

B. Submit the following:

1. Shop drawings
2. Product data

1.6 WARRANTY/GUARANTEE

A. All work and materials are subject to the general warranty as described in the General Conditions of the Contract and in Division 1, General Requirements.

PART 2 – PRODUCTS

2.1 GENERAL

A. All vibration control apparatus shall be furnished by a single recognized manufacturer. The manufacturer shall submit to the Architect/Engineer evidence affirming that he has been a supplier of vibration control devices of the type required for the past five years.

B. The vibration control apparatus manufacturer shall supervise, inspect, measure, and approve the installation and shall submit a report to the Architect/Engineer substantiating that all the equipment has been adequately isolated.

C. Any requests for changes in the specifications must be submitted in writing in time for review and approval through a written addendum to the specifications prior to bid closing.

D. Unless otherwise indicated or specified, all equipment mounted on vibration isolator bases shall have a minimum operating clearance of 1 inch between the base and the floor or housekeeping and beneath. Clearance space shall be checked to insure that no scrap, rubbish, hardware, etc., has been left to possibly short circuit isolated base.

E. In connecting isolated HVAC equipment to rest of system, care must be exercised to insure proper installation.

1. Equipment connected to water piping shall be erected on isolators or isolated foundations to correct operating height prior to making piping connections to avoid misalignment problems. To facilitate this, equipment shall be blocked-up with temporary shims to final operating height. When full load is assembled and water is in system, isolators shall then be adjusted to take up load just enough to allow removal of shims.

2. Air handling equipment such as centrifugal fans shall be erected on isolators and leveled with fan operating before flexible duct connection is made. Insure that duct position is in proper alignment and providing proper clearance in proportion to flexible duct connector length. When fan is shut off, misalignment with ductwork is allowable providing it does not strain or damage flexible duct connector. In cases of high static pressure, fans requiring position stabilizers are to be adjusted when fan is operating to achieve the results as described above with isolator adjustment.

F. Vibration isolator sizes and location shall be determined by the vibration control products manufacturer or as specified herein.

G. Model numbers of Amber/Booth Co., are given for identification. Products of specified manufacturers will be acceptable, provided they comply with all of the requirements of this specification.

2.2 ISOLATOR TYPES

A. Pump Mounted Inertia Pads:

1. Frame to be structural steel with built-in height saving bracket for recessing into a CPF concrete inertia block for side access.

2. Spring to be adjustable, free-standing, open-spring mounting with combination leveling bolt and equipment fastening bolt. The spring shall be rigidly attached to the spring mounting baseplate and compression plate. The isolator shall be designed for a minimum Kx/Ky (Horizontal-to-Vertical spring rate) of 1.0. A neoprene pad having a minimum thickness of 1/4" shall be bonded to the baseplate. Amber/Booth Type CPF with RSW-1.

B. Piping in Mechanical Room, In-Line Pumps:

1. Type PBSR: for first two hangers in horizontal piping adjacent to isolated equipment and for all hangers on 8" and larger pipe, except the first two hanger points adjacent to riser shall be Type BS.

2. Type BSR for remaining hangers in horizontal piping.

3. Type SW for pipe risers. Isolator base plates shall be provided with holes for bolting and isolation grommets.

4. Type SW for floor supports except Type CT for first floor support adjacent to equipment isolated on CT isolators.

C. Fans and Air Handling Units:

1. For slab on-grade installations, provide:

a. Type SP – NR = Double Deflection Neoprene: Shall include neoprene covered steel support plated (top and bottom), friction pads, and necessary bolt holes. Design isolators to support loads up to 50 pounds per square inch.

2. For floors above-grade, up to 40 ft. span, provide:

a. Type SW = Spring Isolators: Shall be free-standing, laterally stable and include acoustical friction pads and leveling bolts. Isolators shall have a minimum ratio of spring diameter-to-operating spring height of 1.0 and an additional travel to solid equal to 50 percent of rated deflection.

b. Type PBSRA - Combination Neoprene and Spring: Vibration hanger shall contain a spring and double deflection neoprene element in series. Spring shall have a diameter not less than 0.8 of compressed operating spring height. Spring shall have a minimum additional travel of 50 percent between design height and solid height. Spring shall permit a 15 degree angular misalignment without rubbing on hanger box.

c. Thrust Restraints: Restraints shall provide a spring element contained in a steel frame with neoprene pads at each end attachment. Restraints shall have factory preset thrust and be field adjustable to allow 1/4" maximum movement when the fan starts and stops. Restraint assemblies shall include rods, angle brackets and other hardware for field installation.

D. Suspended Fans and H&V Units

1. For floors above-grade, up to 40 ft. span, provide:

a. Type SW = Spring Isolators: Shall be free-standing, laterally stable and include acoustical friction pads and leveling bolts. Isolators shall have a minimum ratio of spring diameter-to-operating spring height of 1.0 and an additional travel to solid equal to 50 percent of rated deflection.

b. Type PBSRA - Combination Neoprene and Spring: Vibration hanger shall contain a spring and double deflection neoprene element in series. Spring shall have a diameter not less than 0.8 of compressed operating spring height. Spring shall have a minimum additional travel of 50 percent between design height and solid height. Spring shall permit a 15 degree angular misalignment without rubbing on hanger box.

c. Thrust Restraints: Restraints shall provide a spring element contained in a steel frame with neoprene pads at each end attachment. Restraints shall have factory preset thrust and be field adjustable to allow 1/4" maximum movement when the fan starts and stops. Restraint assemblies shall include rods, angle brackets and other hardware for field installation.

E. Rooftop AHU's:

1. Type RTIR: Provide an extruded aluminum rail base for rooftop air conditioning units consisting of a pair of weatherproofed aluminum rails for fastening to equipment and to roof curb incorporating wind restraints and a continuous air and water seal which is protected from accidental puncture and direct sunlight by an aluminum weather shield. Rails shall incorporate non-adjustable Type SW spring isolators properly spaced around perimeter and sized for 1" deflection. To prevent leaks, rails shall be factory assembled (to the limits of freight carriers) and shipped as a one- piece unit.

F. Cooling Towers or Closed Circuit Cooler:

1. Provide hot dip galvanized (if outdoor installation) adjustable, open-spring isolators having coil springs attached to the top compression plate and baseplate. An elastomeric pad having a minimum thickness of 1/4" shall be bonded to the baseplate. Nuts, adjusting bolts, and

washers shall be zinc-electroplated.

2. The spring assembly shall be removable and shall fit within a welded steel enclosure consisting of a top plate and rigid lower housing. Isolated restraining bolts shall connect the top plate and lower housing to prevent the equipment from rising when drained of water. Amber/Booth Type CT/CTC.
3. Provide a hot dipped galvanized structural steel base for increasing rigidity of equipment. The steel members shall have a minimum depth of 1/12 of the longest span, but not less than 6" deep.
4. Junior beams and junior channels shall not be used. Cross members shall be provided where necessary to support the equipment or to prevent twisting of the main members.

G. Ductwork and Equipment Lagging:

1. The barrier shall be constructed of 0.10” thick barium sulphate loaded limp vinyl sheet bonded to a thin layer of reinforced aluminum foil on one side.
2. The barrier shall have a nominal density of 1 psf and shall have a minimum STC rating of 28.
3. The barrier shall exhibit minimum flammability ratings of 0.0 seconds for flame out and after glow and 0.2 inches for char length when tested in accordance with Federal Test Standard No. 191-5903.
4. The barrier shall have a minimum thermal conductivity “K” value of 0.29 and a rated service temperature range of 40°F to 220°F. When tested for Surface Burning Characteristics per ASTM E84, the barrier will have a flame spread index of no more than 10 and a smoke development index of no more than 40.
5. The decoupling layer shall be a combination of 1”, 2” fiberglass batting, non-woven porous scrim-coated glass cloth, quilted together in a matrix of 4” diamond stitch pattern which encapsulates the glass fibers. The barrier shall be Type KNM-100-ALQ-1 or 2 and the decoupling layer shall be type KFA by Kinetics. The composite material shall be fabricated to include a nominal 6” wide barrier overlap tab extending beyond the quilted fiberglass to facilitate a leak-tight seal around field joints. Nominal barrier width 54”, nominal decoupler width 48”.
6. Sound Transmission Loss: Tested as a free hanging barrier (ASTM E-90-90)

	Frequency, Hz						
Product	125	250	500	1000	2000	4000	STC
KNM 100ALQ-1	13	16	24	33	43	49	28
KNM 100ALQ-2	11	16	26	35	44	49	28

H. Manufacturers: Amber/Booth, Kinetics Noise Control, Mason Industries, Vibration Mounting & Controls, Vibration Eliminator, Inc., Vibro-Acoustics.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's specifications and instructions.

1. No metal-to-metal contact will be permitted between fixed and floating parts.
2. Connections to Equipment: Allow for deflections equal to or greater than equipment deflections. Electrical, drain, piping connections, and other items made to rotating or reciprocating equipment (pumps, compressors, etc.) which rests on vibration isolators, shall be

isolated from building structure for first three hangers or supports.

3. Common Foundation: Mount each electric motor on same foundation as driven machine. Hold driving motor and driven machine in positive rigid alignment with provision for adjusting motor alignment and belt tension. Bases shall be level throughout length and width. Provide shims to facilitate pipe connections, leveling and bolting.
4. Provide heat shields where elastomers are subject to high temperatures.
5. Extend bases for pipe elbow supports at discharge and suction connections at pumps. Pipe elbow supports shall not short circuit pump vibration to structure.
6. Non-rotating equipment such as heat exchangers and convertors shall be mounted on isolation units having the same static deflection as the isolation hangers or support of the pipe connected to the equipment.
7. Ensure that the outer surface of the equipment or duct is clean and free of dust, dirt or similar foreign matter. If desired, the outside surface can be painted with a rust-resistant paint in order to minimize potential corrosion.
   a. Field cut and apply the insulation decoupler to the outside of the duct. Obtain a uniform thickness by butting all seams together (do not overlap). At elbows or similar transitions, field measure and miter cut the insulation to fit. Ensure that the insulation is not compressed by the fastener used, if any.
   b. Wrap the noise barrier around the equipment housing or insulation-wrapped duct. At all seams, overlap the barrier by a minimum of 2” and adhere using adhesive. Alternately, the barrier can be butted together at joints with the seam covered by a 2” (50 mm) wide cut piece of the barrier material. This strip is then adhered to the barrier on either side of the seam using adhesive.
   c. If desired, metal or nylon bands can be wrapped around the outside of the barrier to guard against the potential of adhesive failure. If used, this banding should be placed on either side of all radial seams in addition to the midpoint on longer sections. Ensure that the banding is snug only and does not result in compression of the insulation decoupler beneath.
   d. In lieu of banding, insulation “stick pins” can be used to reinforce the seams in the noise barrier. Ensure that the pin does not compress the insulation or barrier material beneath.

B. Inspection and Adjustments: Check for vibration and noise transmission through connections, piping, ductwork, foundations, and walls. Adjust, repair or replace isolators as required to reduce vibration and noise transmissions to specified levels.

END OF SECTION

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SECTION 23 05 93

TESTING & BALANCING OF MECHANICAL SYSTEMS

PART 1 – GENERAL

1.1 JOB CONDITIONS

A. Systems shall be completely installed and in continuous operation as required to accomplish the tests.

B. Heating, ventilating and air conditioning equipment shall be completely installed and in continuous operation as required to accomplish the balance work specified.

C. Adjust and balance shall be performed when outside conditions approximate design conditions indicated for heating and cooling functions.

D. Make at least two inspections of the mechanical systems during construction to verify that balancing procedures may be accomplished. Report findings to the Architect/Engineer/Construction Manager.

E. Balancing firm shall balance Mechanical System two (2) times. The first time shall be considered a rough balance. Any discrepancy in air flow shall be addressed to the Architect/Engineer/Construction Manager. The final balancing will be accomplished after review of rough balance reports.

F. The final balancing reports shall be submitted and approved prior to project's being considered complete; i.e., commencement of warranties.

1.2 ENGINEER QUALIFICATIONS

A. The firm shall be an independent organization having no affiliation with construction contractors, equipment sales or design engineering.

B. The firm shall specialize in balancing heating, ventilating and air conditioning systems.

C. The firm shall show proof of having balanced and tested at least five projects of similar size and scope.

D. All field work shall be under the direct supervision of a registered Professional Engineer who is a full-time employee of the balancing firm.

E. The firm shall be certified by and a member of the AABC (Associated Air Balance Council), or NEBB (National Environmental Balancing Bureau).

1.3 REPORT

A. Data Sheets:

1. Submit data sheets on each item of testing equipment required.
2. Include name of device, manufacturer’s name, model number, latest date of calibration and correction factors.

B. Report Forms:

1. Submit specimen copies of report forms.
2. Forms shall be 8-1/2 x 11 inch paper for loose-leaf binding, with blanks for listing of the required test ratings and for certification of report.
3. Reports shall be on standard forms published by AABC or NEBB.

PART 2 – PRODUCTS

2.1 AIR BALANCE INSTRUMENTS

A. Alnor Velometer with probes and alnor pitot tube.

B. Rotating Vane Anemometer: 4 inch size.

C. ASHRAE Standard Pitot Tubes, stainless steel 5/16 inch outside diameter, lengths 18 inches and 36 inches.

D. Magnehelic Differential Air Pressure Gauges, 0 to 0.5 inches, 0 to 1.0 inch and 0 to 5.0 inches water pressure ranges, each arranged as a portable unit for use with a standard Pitot tube.

E. Combination Inclined-Vertical Portable Manometer, range 0 to 5.0 inches water.

2.2 WATER BALANCING INSTRUMENTS

A. 30 Inch Mercury U-Tube Manometer, 200 psig, with 3 valve bypass assembly and return wells or mercury check valves.

B. Inspector's gauge testing set.

C. Water Differential Pressure Gauge, 4-1/2 inch dial, 0 to 100 psi range.

D. Pressure gauge measurement points, quick connect couplings, 1/4 inch psi.

2.3 SYSTEM PERFORMANCE MEASURING INSTRUMENTS

A. Insertion Thermometers, with graduation at 0.5 degrees F for air and 0.1 degrees F for water.

B. Sling Psychrometer.

PART 3 – EXECUTION

3.1 GENERAL REQUIREMENTS

A. Arrange and pay for all tests.

B. Notify Architect/Engineer/Construction Manager at least three working days in advance of test and conduct in presence of Architect/Engineer/Construction Manager.

C. Tests to be performed prior to insulation, covering or concealment.

D. Provide signed report of completion of test with signature of witnesses. Report shall indicate:

1. System Tested
2. Date
3. Specified test requirements and actual testing results

E. The balancing firm shall report to and review the work required with the Architect/Engineer before beginning field balance work. The balancing firm shall make at least two inspections of the air systems during construction and shall report his findings in writing to the Architect/Engineer.

F. The balancing firm shall cooperate with the Architect/Engineer/Construction Manager and the Mechanical Contractor to effect smooth coordination of the balancing work with the job schedule.

G. The balancing firm shall be responsible for getting the various systems into proper operation. They shall enlist the aid of the equipment suppliers and Mechanical Contractor as may be required to effect proper operation consistent with the contract plans and specifications.

H. When the balancing firm cannot balance a belt-driven piece of equipment with the supplied belts and sheaves, inform the Mechanical Contractor that the Mechanical Contractor shall provide additional sheaves as spelled out in other Division 23 Sections.

3.2 CIRCULATING WATER SYSTEM TEST

A. All piping tests shall be applied not only to piping, but also to all devices and equipment connected thereto with the exception of control valves, boilers or any other equipment which may be damaged by the test pressure. All valves shall be full open.

B. Test at 100 psi hydrostatic pressure for 6 hours:

1. Record pressures each hour
2. Repair all leaks
3. Retest until 6 hours can be completed with no leaks or loss of pressure.

C. After completion of successful test, strainers shall be cleaned, then system shall be backflushed and strainers cleaned again.

3.3 DUCTWORK TESTING

A. Witness testing conducted by the Mechanical Contractor per Section 230600, PART 3: EXECUTION.

3.4 BALANCING PROCEDURE

A. Air System Balance:

1. With the fan supply system set to handle normal minimum outdoor air, the balancing firm shall perform the following tests and compile the following information:

   Air Handling Equipment

   a. Design Conditions:
      (1) CFM Supply Air
      (2) Static Pressure
      (3) CFM Fresh Air
      (4) Fan RPM
   b. Installed Equipment:
      (1) Manufacturer
      (2) Size/Model Number
      (3) Motor HP, Voltage, Phase, Full Load Amperes
   c. Field Test:
      (1) Fan Speed
      (2) No Load Operating Amperes
      (3) Fan Motor Operating Amperes
      (4) Calculated BHP
   d. Test for Total Air:
      (1) Size of discharge, return air and outside air ducts.
      (2) Number and locations of Velocity Readings taken.
      (3) Duct Average Velocity
      (4) Total CFM
      (5) Outside Air CFM
      (6) Return Air CFM
   e. Individual Outlets (Diffusers, Registers and/or Grilles):
      (1) Identify each outlet or inlet as to location and area and fan system
      (2) Outlet, manufacture and type
      (3) Outlet size
      (4) Outlet free area, core area, or neck area
      (5) Required FPM and test velocity found for each outlet.
      (6) Required CFM and test results for each outlet
   f. Test for room/space pressurization

(1) As noted on the drawings or as required, final balancing shall include room/space pressure adjustments

(2) As confirmed in writing by the Engineer, the supply, return, and/or exhaust air shall be adjusted to required pressure relationship (positive, neutral, negative) while maintaining required total air changes.

2. After completion of tests, adjustment and balancing under minimum fresh air conditions, set the system for 100% fresh air. Repeat the total CFM tests to check field versus design conditions. The results under 100% fresh air cycle shall agree with conditions found under "minimum fresh air operation" before the system is considered to be in balance. Adjustments of the proper dampers shall be made to achieve balance.

3. Testing and adjusting of individual outlets shall be performed under procedures recommended by the manufacturers of the outlets. All outlets shall be set for air pattern required and all main supply air and return air dampers to be adjusted and set for design CFM indicated. Any required changes in air patterns, settings, etc., necessary for achieving correct air balance, shall be provided by this Contractor. Total CFM of all outlets shall agree with total CFM of all branches and the grand total shall agree with the air volume for the fan(s).

END OF SECTION

SECTION 23 07 00
HVAC INSULATION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the contract, including the conditions of the contract (General, Supplementary and other Conditions, if any) and Division 1 as appropriate, apply to the work specified in this section.

B. Refer to Section 23 00 00 for HVAC General Provisions

C. Refer to Section 23 05 00 for Common Work Results for HVAC.

1.2 DESCRIPTION OF WORK

A. This Section includes insulation and covering provided on the following piping and equipment:

1. Refrigerant Piping.

12. Acoustic Duct Liner

B. Insulation shall be installed on the following duct systems:

1. All supply ductwork.
2. All return ductwork.
3. All outside air intake and relief ductwork.
4. All ductwork connected to energy recovery units.

1.3 REFERENCE STANDARDS

A. Refer to Section 23 00 00 for a general description of requirements applying to this section.

1.4 QUALITY ASSURANCE

A. Refer to Section 23 05 00 for a general description of requirements applying to this section.

B. Install insulation in accordance with manufacturer's recommendations.

C. Provide adequate supervision of labor force to assure that all aspects of the specifications are being fulfilled.

1.5 SUBMITTALS

A. Submit shop drawings, installation instructions, and manufacturer's literature of all materials specified in accordance with Section 23 00 00.

B. Submit fabrication instructions for pipe fitting and valve insulation.

C. Submit manufacturer's joining recommendations for butt joints and longitudinal seams.

1.6 WARRANTY/GUARANTEE

A. All work and materials are subject to the general warranty as described in the General Conditions of the Contract and in Division 1, General Requirements.

PART 2 – PRODUCTS

2.1 DUCT INSULATION

A. Concealed Supply, Return, Relief, and Outside Air Ductwork, and all ductwork connected to energy recovery units: Fiberglass duct wrap bonded with resins, 3/4 pound density, aluminum foil facing reinforced with fiberglass scrim, laminated to Kraft, 2" thick.

1. Thermal Conductivity: 0.27 Btu/Hr./SF/Inch at 75 degrees F. Min. installed "R" value w/25% compression shall be 5.6.

2. Duct wrap shall be cut to stretch-out dimensions as provided in manufacturer's instructions. Remove a 2" piece of insulation from the facing at the end of the piece of insulation to form an overlapping staple and tape flap. Install with facing outside so tape flap overlaps insulation and facing at other end. Insulation shall be tightly butted and not compressed excessively at duct corners. Seams shall be stapled 6" on center with outward clinching staples. All seams, tears, punctures and other penetrations of the insulation facing shall be sealed with foil tape or vapor proof mastic. Where rectangular ducts are 24" in width or greater, duct wrap shall be secured to the bottom of the duct with mechanical fasteners; i.e., stick pins spaced 18" on center.

B. Exposed supply, return, relief, and outside air ductwork, and all ductwork connected to energy recovery units, shall be insulated in finished conditioned spaces, penthouse, mechanical rooms, mezzanine areas, equipment closets, and non-conditioned spaces with 2" thick rigid fiberglass board. Insulation shall be 6 P.C.F. density with a "K" value of 0.25 Btu/Hr./SF/Inch at 75 degrees F. mean temperature and shall be U.L. listed at 25 maximum for flame spread, and 50 maximum for smoke developed. Insulation shall be applied using Graham Pins or Stik-Clips and all seams, edges and breaks shall be sealed with 4" matching tape and sealed with Vicryl CP-10 to match ASJ jacket. Insulation shall be provided with all-service jacket facing.

C. Manufacturers: Johns Manville Corp., Certain-Teed or Owens- Corning, Knauf.

D. Outdoor Installation:

1. Two Inch (2") thick Arma Tuff supplied in sheet and roll forms laminated with a white, 0.012" thick thermoplastic rubber membrane.
2. Material shall be resistant to ozone and ultraviolet radiation with a of 10-year limited warranty against breakdown of the membrane.
3. Thermal conductivity shall be 0.25 at 75°F mean temperature with a vapor permeability of 0.05 perm-inch for the foam and 0.00 for the laminate.
4. Insulation shall be applied using Armaflex 520 adhesive; seams shall be covered with minimum 6-inch-wide self-sealing tape and minimum 6-inch-wide self-sealing tape along all exposed edges. Install per manufacturer's instructions.
5. Minimum insulation value shall be R-8.
6. Coordinate with the work of Section 230600 to ensure that the top of all single wall, square or rectangular horizontal ductwork is crowned to minimize accumulation of weather on top of the finished insulation jacket.

2.2 CALCIUM SILICATE INSULATION

A. Material: Insulation for hot equipment shall be heavy density fiberglass insulation retained by .016" aluminum held in place by 1"x25 gauge stainless steel bands spaced on a maximum center distance of 12". All joints and voids shall be filled with insulating cement, well trowelled into the openings. Cleanouts, manholes and nameplates shall not be insulated, and the insulation shall be neatly beveled off at such openings.

B. Thickness: 3-1/2" thick.

K Factor @ 200 deg. F = 0.38 – Surface Temperature 87°F

K Factor @ 600 deg. F = 0.90 – Surface Temperature 112°F

C. Equipment Included:

1. Steam or Hot Water Convertor or Heat Exchanger
2. Field Fabricated Boiler Breaching
3. High Temperature Water (up to 250°F) Storage Tanks.

4. Steam Condensate Receivers.
5. Steam Flash Tanks.

D. Manufacturers: Industrial Insulation Group.

2.3 KITCHEN HOOD DUCT INSULATION & FIRE RATED AIR DUCTWORK

A. Materials: Non-mineral wool, passive, low biopersistant fiber, ceramic blanket insulation totally encapsulated on all sides with aluminum foil scrim on kitchen hood exhaust duct.

B. Installation shall be 1 layer, 2" thick to provide 2-hour protection on grease duct. Apply directly to the duct with zero clearance to combustibles at the overlap.

C. Secure with metal bands per manufacturer's recommendations on type and spacing. For ducts spacing 24" or greater, secure with insulation pins on the bottom of horizontal runs and on vertical runs to prevent sagging.

D. Manufacturers: Thermal Ceramics - Firemaster Fast Wrap Plus, ETS Schaefer or Pyroscat.

1. Contractor may provide an agency approved, single layer system of 6 PCF density, 1.5 inch thick, passive fire protection blanket installed as a two-hour rated enclosure system, Type FSB Ultra, as made by ETS Schaefer, or Unifrax FyreWrap® Elite 1.5.
2. Contractor may provide an agency approved, single layer system of insulation which consists of glass fiber blanket completely encapsulated in a UL Classified fiberglass reinforced foil facing, 2 inches thick, as a two-hour rated enclosure system. Type FlameChek Plus2, as made by CertainTeed Insulation Group.

2.4 ACOUSTIC DUCT LINER

A. Duct liner shall be designed for use as an acoustical insulation to absorb air conditioning noise in sheet metal ducts and plenums operating at velocities up to 6000 fpm and temperatures up to 250 deg. F.

B. Duct liner shall be open-cell melamine-based foam, 0.5 to 0.7 pounds per cubic ft. or, AP Coilflex flexible elastomeric foam meeting ASTM C1534, or, AP Armaflex Duct Liner / Wrap.

C. Duct liner shall comply with the requirements of NFPA 90A and 90B. Surface burning characteristics shall comply with UL Standard 723 for 25/50 flame and smoke development.

D. Duct liner shall comply with the property requirements of ASTM Specification C1071 Type 1, or ASTM C1534. Material shall resist fungal and bacterial growth when subjected to ASTM G21 and G22 test methods.

E. Material thickness, name of manufacturer and type shall be printed on the air stream side of the liner for ease of identification.

F. Manufacturers: Pinta-Acoustic "Willduct" acoustical duct liner, natural white or gray, 1" thick; Armacell.

PART 3 – EXECUTION

3.1 INSTALLATION – GENERAL

A. Do not install until systems have been tested and meet requirements.

B. Heavy work which may damage insulation shall have been completed in the vicinity of the insulation work.

C. Provide non-compressible insulation saddles at all piping hanger locations, and at all piping hanger locations where piping is insulated with flexible closed cell insulation.

Option: Provide insulation coupling system as made by Klo-Shure Co.

D. All installations shall be made by skilled craftsmen regularly engaged in this type of work.

E. Insulation shall be continuous thru-wall, ceiling and floors.

F. Metal shields, 16 gauge galvanized, shall be installed between hangers and pipe insulation.

G. Pipe, ductwork and equipment shall be clean and dry prior to insulating.

H. Install all insulation per manufacturer's instructions.

I. To avoid undue compression of insulation, provide solid core inserts at all supports as recommended by the insulation manufacturer. Provide insulation shields between the insulation jacket and the hanger.

J. Ductwork treated with internal acoustic duct liner does not require external insulation.

3.2 PIPE INSULATION – TYPES & THICKNESSES

A. Provide fiberglass insulation of thickness specified on:

1. Refrigerant Piping: Interior locations, exposed and concealed for suction lines and hot gas bypass lines, if applicable. (NOTE: Insulate liquid line if metering device is mounted at the condensing unit.) Option: Flexible closed cell insulation

   Suction Line:

   1/2" for piping 1-1/4" and below

   1" for piping 1-1/2" and larger

   Hot Gas Bypass: (Liquid Line)

   1" for piping 1-1/4" and below

   1-1/2" for piping 1-1/2" and larger

B. Provide flexible closed cell insulation of thickness specified on:

1. Refrigerant Piping: Exterior Locations for suction lines and hot gas bypass lines, if applicable. (NOTE: Insulate liquid line if metering device is mounted at the condensing unit.)

   Suction Line:

   1/2" for piping 1-1/4" and below

   1" for piping 1-1/2" and larger

   Hot Gas Bypass: (Liquid Line)

   1" for piping 1-1/4" and below

   1-1/2" for piping 1-1/2" and larger

2. Cold surfaces of refrigeration equipment, air separators for chilled and heating hot water, and chilled water pumps. 3/4" thickness

3. ½" thickness for condensate drain lines.

3.3 ACOUSTIC DUCT LINER

A. All portions of duct designated on the drawings to receive duct liner shall be completely covered with duct liner, adhered to the sheet metal with a 100% coverage of adhesive complying with ASTM C916.

B. Transverse joints shall be neatly butted and there shall be no interruptions or gaps. All transverse joints and all exposed leading edges shall be coated. The black coated surface of the duct liner shall face the airstream.

C. Duct liner shall be secured with mechanical fasteners which shall compress the duct liner sufficiently to hold it firmly in place.

D. Duct liner shall be cut to assure overlapped and compressed longitudinal joints.

E. After installation is complete, blow out the duct system prior to operation to remove any cutting scraps and foreign material remaining in the duct.

END OF SECTION

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SECTION 23 09 00

INSTRUMENTATION AND CONTROL FOR HVAC

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Section 23 00 00 and drawings are hereby made a part of this section as fully as if repeated herein.

B. The Mechanical Contractor shall coordinate with the work of Division 26 and the Fire Alarm System vendor for locations and mounting of all duct smoke detectors. These devices are shown on the Mechanical Drawings for reference only to show the intent of the work. All locations shall be determined based on approved shop drawings from the Fire Alarm System vendor and the Contractor for the work of Division 26, Electrical.

1.2 DESCRIPTION OF WORK

A. Provide labor, material and supervision necessary to install a complete direct digital control system of temperature controls with a host PC and full color graphics to control all HVAC Systems, associated components and accessories as described herein.

1.3 SUBMITTALS

A. Submit shop drawings and manufacturer's data sheets of all equipment.

B. Submit manufacturer's certificates of conformance with applicable codes.

C. Furnish point-to-point diagram of automatic temperature control system approval, including heating, ventilating and air conditioning equipment wiring diagrams where temperature control connections are required.

D. Provide ten (10) copies of submittal data within thirty (30) days of contract award.

E. Submittal shall consist of:

1. System Architecture showing all digital and pneumatically actuated devices.
2. Equipment lists of all proposed devices and equipment including data sheets of all products.
3. Valve, damper and well and tap schedules showing size, configuration, capacity and location of all equipment.
4. Data entry forms for initial parameters. Contractor shall provide English listing of all analog points with columnar blanks for high and low warning limits and high and low alarm limits, and a listing of all fan systems with columnar blanks for beginning and end of occupancy periods; and samples of proposed text for points and messages (for at least two systems of at least 15 points total) including sample 480-character alarm message. All text shall be approved prior to data entry.
5. Wiring and piping interconnection diagrams including panel and device power and sources.
6. Sketches of all graphics.

1.4 QUALITY ASSURANCE

A. Insure that all work and equipment is installed in accordance with manufacturer's warranty requirements.

B. Provide adequate supervision of labor force to assure that all aspects of specifications are being fulfilled.

C. The system shall be engineered, programmed and installed by personnel trained and regularly employed by the control’s manufacturer.

D. Supplier shall have technical support to promptly respond within 24 hours or less to service calls to the site with technical staff, spare parts inventory and test and diagnostic equipment.

E. Codes and Approvals:

1. The complete system installation shall be in strict accordance with national and local electrical codes. All devices designed for or used in line voltage applications shall be UL listed.

a. All microprocessor based devices shall be UL916 listed.

b. All electrical environmental control and monitoring devices shall be UL429 and/or UL873 listed.

2. All electronic equipment shall conform to the requirements of FCC regulation Class B, Part 15, Section 15 governing radio frequency electromagnetic interference and be so labeled.

3. The complete system shall conform to ANSI/ASHRAE Standard 135-2012, BACNET.

F. All system components shall be designed and built to be fault tolerant.

1. Provide satisfactory operation without damage at 100% above and 85% below rated voltage and at +3 Hertz variation in line frequency.

2. Provide static, transient, and short circuit protection on all inputs and outputs. Communication lines shall be protected against incorrect wiring, static transients and induced magnetic interference. Bus connected devices shall be A.C. coupled or equivalent so that any single device failure will not disrupt or halt bus communication.

1.5 ELECTRICAL WIRING

A. All electrical wiring, components and accessories in connection with the Automatic Temperature Control System shall be furnished and installed by the control manufacturer.

1. Electrical Contractor shall provide all wiring to duct smoke detectors.

2. Unless stated otherwise in the design documents, the ATC Contractor is responsible for providing control power to all valves, actuators, devices and components within the DDC System regardless of the selected voltage of those devices. This also includes all 120 volt power circuits required for devices, panels and control equipment.

3. The ATC Contractor shall be responsible for providing the control interface between terminal unit condensate pumps and their respective units at the required voltage of these devices in order to shut down the terminal unit in the event of high water level in the condensate pump receiver.

1.6 AUTOMATIC TEMPERATURE CONTROL

A. Provide a DDC System of automatic temperature control which shall be as manufactured by Alerton Technologies, Inc., as installed by Albireo Energy, Johnson Controls, Inc., as installed by Modern Controls, Inc., Staefa Control System as installed by Automatic Control Systems, Inc., Automated Logic Corp., as installed by Radius Systems, and Schneider EcoStruxure, as installed by Tri-M Group, LLC. The system shall be complete in all respects including labor, materials, equipment and services necessary.

B. All electrical wiring in connection with the installation of the automatic temperature control system shall be furnished and installed under the direct supervision of the control manufacturer.

PART 2 – PRODUCTS

2.1 BMCS COMPUTER HARDWARE

A. Central Hardware: The central BMCS facility shall be located in the Building Engineer's Office as shown on the drawings and shall meet the following minimum criteria:

1. A Personal Computer (PC) based central, with minimum Intel Pentium Processor 2.8 GHz

minimum clock speed, and Intel motherboard. PC shall be provided with a minimum of 2 GB of RAM, 1.44 MB diskette, 6 USB ports on the back and 2 on the front, 80 GB EIDE hard drive suitable for peripherals and applications herein specified and DVD ROM. Operator Work Station (OWS) shall include mouse, keyboard, ink-jet printer and 19-inch flat panel, monitor, an internal 56K modem connected to a PCI slot, and "NIC" card for network interface.

B. Portable Computer: Provide the following:

1. A laptop computer (PC) based central, with minimum Pentium processor, 1 GHZ minimum clock speed. PC shall be provided with a minimum of 256 MB of RAM, 1.44 MB diskett drive, 20 GB EIDE hard drive suitable for peripherals and applications herein specified, dual scan screen with 800 x 600 minimum resolution and 16,700 colors minimum, two-type 2 PC slots, 56.0 modem, CD-Rom and "NIC" card or PCMCI card.
2. Operator work storage cabinet shall be provided by the Owner.

C. Communications to other Facilities: Provide host software necessary for remote control of the BMCS. The BMCS manufacturer shall provide and install remote software in two existing DFM computers. A dial-up communications package shall allow a remote user to take control of the host PC via standard modems and phone connections. The phone lines shall be provided by the Owner.

2.2 TEMPERATURE SENSORS

A. Solid state room sensors shall be of the wire wound resistance type element. Sensors shall be equipped with visual readout and adjustment. Sensors shall be of the completely solid state type with no moving contacts. Printed circuit board under thermostat cover shall contain a low mass resistance type setpoint dial and amplifier. Provide test points for measuring output voltage. Sensors shall be direct or reverse acting as required for the sequence of operation.

B. Sensors shall provide the application for night setback override.

C. Sensors shall be mounted at ADA height (48" above floor).

2.3 SMOKE DETECTORS

A. Duct type ionization smoke detectors shall be furnished by the Electrical Contractor and installed by the Mechanical Contractor in the supply and return air stream. The Electrical Contractor shall provide wiring from each detector to the Fire Alarm System panel.

B. The Electrical Contractor shall provide an alarm output signal from the FAS panel to the BAS for unit shutdown.

2.4 ACTUATORS

A. Electronic actuators shall be sized to operate their appropriate dampers and valves with sufficient reserve power to provide smooth modulating action or two-position action as specified.

B. Provide integral, auxiliary switches for direct coupled actuators to indicate when a desired position is reached or to interface additional controls for a specific sequence.

C. Align actuator with drive shaft, provide permanent mark to identify closed position of end device.

2.5 SENSOR TRANSMITTERS

A. Duct and immersion sensors shall have minimum spans as required to meet the temperature requirements. Duct sensors shall have sensing elements of sufficient length and accuracy to measure average duct temperature in each location.

B. Sensors shall be of corrosion resistant construction, tamperproof, suitable for mounting on a vibrating surface. Exposed capillaries shall be temperature compensated, and armored or installed in protective tubing.

C. All sensing elements for water pipe mounting shall be of the rod and tube type with linear output and shall be furnished complete with separable protecting wells filled with heat conductive compound. Sensors shall be factory calibrated and tamperproof. If easily adjustable sensors are provided, they shall be located inside metal enclosures with cylinder lock and key to prevent unauthorized setting.

D. Safety Devices: Provide the following:

1. Low limit, electric type, with 20' long serpentine element, with manual reset, set for 37°F for "freeze" protection and 55°F for fan discharge application, unless otherwise noted.
2. Air and water duty flow switches: Differential pressure type for fan and pump status.
3. Carbon monoxide sensor/transducer/meter shall be analog type, requiring no field or periodic calibration, suitable for wall mounting.
   a. Microprocessor controlled digital display of 0 to 250 ppm CO.
   b. Analog output of 4 to 20 milliamps.
   c. UL listed housing, suitable for an operating environment of 0 to 125 F/ 10 to 90% RH.
   d. Repeatability of +/- 10% at 50 ppm; linearity of +/- 10%.
   e. Power input of 3.5 watts at 24 VAC.
   f. Make: Macurco inc. model CM-2B.
   g. Manufacturers: Air Test Technologies, Inc., Macurco, Rotronic Instrument Corp., Vaisala, Inc.
4. Carbon dioxide sensor/transducer suitable for wall or duct mounting.
   a. Analog output of 4 to 20 milliamps corresponding to 0 to 2000 ppm CO2.
   b. ABS plastic housing, suitable for an operating environment of 0 to 125 F/ 0 to 100% RH, non-condensing.
   c. Repeatability less than +/- 20 ppm.
   d. Response time less than 60 seconds.
   e. Power supply, 24 VAC.
   f. Make: Vaisala Inc. model GMD 20 (duct)
   g. Manufacturers: Air Test Technologies, Inc., Macurco, Rotronic Instrument Corp., Vaisala, Inc.
5. Make-up Water Monitoring System (Typical for chilled water & hot water heating system):

   (Manufacturer's Rep. 888-397-5353)
   a. Monitor data as received by flow meter on cold water make-up system. When flow exceeds 10 gal./1 min (adj.), ATC system to close normally open solenoid valve, alarm system (provide call out), shutdown boilers, pumps, chillers, etc., associated with respective system.
   b. Flow sensor, consisting of a removable flow sensor mounted in cast bronze housing, available in ½" to 1-1/2" pipe size. Sensor shall be rated for a flow range of 0.5 to 15 feet per second, 220°F max., 400 psig at 100°F max. pressure; Nylon impeller, Pennlon bearing, tungsten carbide shaft, PPS housing and EPDM seals. Manufacturer: Kele Model 250B, Data Industrial Series 250BR.
   c. Programmable analog flow transmitter shall be a loop-powered device that converts a flow sensor signal into a linear 4 – 20 mA signal. Electronic signal dampening, computer programmable, compact size in a metal enclosure. Power input, 9-35 VDC/0-1 kHz, 75 ohms at 24 VDC, accuracy of 0.1% of full scale. Manufacturer: Kele Model 310-02, Universal

Flow Transmitter Model UFT-1.

6. Liquid Leak Detection System: Kele, Raychem, Trace Tek.
   a. Mechanical float devices attached to or inserted within the auxiliary pan are not acceptable.
   b. Sensor shall be activated when there is at least ¼ inch of water, but no more than ½ inch of water in the auxiliary pan.
   c. Equal to Kele Model WD-1B water detector.
      (1) Weatherproof cast aluminum enclosure with adjustable mounting feet.
      (2) 11-27VAC/VDC, 60 Hz, SPDT alarm contacts.
      (3) LED indicators for power (green) and alarm (red).
      (4) Fully adjustable detection level.

E. HUMIDITY TRANSMITTERS

1. Units shall be suitable for duct, wall (room) or outdoor mounting. Unit shall be two-wire transmitter utilizing bulk polymer resistance change or thin film capacitance change humidity sensor. Unit shall produce linear continuous output of 4-20 mA for percent relative humidity (%RH). A combination temperature and humidity sensor may be used for zone level monitoring. Sensors shall have the following minimum performance and application criteria:
   a. Input Range: 0 – 100% RH
   b. Accuracy (%RH): +/- 2% (when used for enthalpy calculation, dewpoint calculation or humidifier control) or +/- 3% (monitoring only) between 20-90%RH at 77°F, including hysteresis, linearity, and repeatability.
   c. Sensor Operating Range: As required by application.
   d. Long Term Stability: Less than 1% drift per year.
2. Acceptable Manufacturers: Units shall be Vaisala HM Series, General Eastern, Microline, or Hy Cal HT Series.

2.6 CONTROL DAMPERS

A. The ATC Sub-contractor shall furnish all the controlled dampers of the type and sizes indicated on the drawings for installation by the sheet metal Sub-contractor.

B. All 2-position control dampers shall be parallel blade and sized for minimum pressure drop, at the specified duct size.

C. All modulating dampers shall be opposed blade and sized for an effective linear air flow control characteristics within the angle of rotation and maximum pressure drops specified. Information shall be provided to the sheet metal Subcontractor for determining the proper duct reductions or baffles used.

D. Damper frames shall not be less than 16 gauge galvanized steel, formed with corner braces for extra strength, with mounting holes for enclosed duct mounting.

E. All damper blades shall be of not less than 16-gauge galvanized steel formed for strength and high velocity performance. Blades on all dampers must not be over 8" in width. Blades shall be secured to 1/2" diameter zinc plated axles by zinc plated bolts and nuts. All blade bearings shall be nylon or oilite. Blade side edges shall be sealed off against spring stainless steel seals. Teflon coated thrust bearings shall be provided at each end of every blade to minimize torque requirements and insure smooth operation. All blade leakage hardware shall be constructed of corrosion resistant, zinc plated steel and brass.

F. Dampers shall be suitable for operation between -40 and 200 degrees. The control manufacturer shall submit leakage and flow characteristics plus a size schedule for all controlled dampers.

G. All blade edges shall have inflatable seal edging that shall be rated for leakage less than 10 cubic feet per minute per square foot of damper area at a differential pressure of 4" of water when the damper is being held by a torque not to exceed 50 inert lbs. Leakage shall not exceed 1/2 of 1% of total flow.

H. Provide permanent mark or scribe end of drive shaft to align damper with actuator in closed position.

2.7 CONTROL CABINETS

A. Control cabinets shall be constructed of 18-gauge steel with locking hinged door. Unless otherwise specified, all controllers, electric relays, switches and other equipment furnished as part of the control system which are not required to be mounted on mechanical equipment, shall be cabinet mounted. The temperature indicators and switches shall be flush mounted on the door tagged with plastic labels. All electrical devices shall be wired to a numbered terminal strip and all devices shall be completely adjusted and checked for proper operation prior to shipment to job site. All wiring shall be numbered according to the control diagram.

2.8 MOTORIZED, ROTARY ELECTRIC CONTROL VALVES

A. Capacitor type reversible electric motor, gear train, limit switches and terminal block in a die-cast aluminum enclosure, NEMA 4, for outdoor locations.

B. Output shaft shall e nickel plated to prevent corrosion. Actuator shall be suitable for any mounting position, in ambient range from -40 to +150°F.

C. Actuator shall be sized against the operating torque required by the butterfly valve manufacturer.

D. Motor shall be fractional horsepower, permanent split capacitor type designed for 120 VAC, 1 phase supply.

E. Reduction gearing shall be hardened alloy steel, permanently lubricated. Two (2) adjustable CAM actuated end travel limit switches shall be provided to control direction of travel.

F. Actuator shall be provided with handwheel for manual override operation of the valve in the event of malfunction or power failure. Handwheel shall be permanently attached to the actuator.

G. When in manual, the electric drive mechanism shall be locked out for safety.

H. Actuator shall have visual indication of valve position.

I. Valve actuator shall be Raymond Control Systems MAR-100 Series with Dezurik high performance butterfly valve.

2.9 SEQUENCE OF OPERATION

A. Host Computer and Operator's Work Station (OWS)

1. The host computer and accessories shall be located in the Janitor's Office on the second floor of Area 'E'. Coordinate exact location with the owner.
2. All control programs and application features shall reside in the OWS.
3. Control manufacturer shall provide subsequent levels of control capability to whatever extent necessary to achieve performance required for individual units in their respective local control panels.
4. Work with the Owner to establish occupied/unoccupied schedules and setpoints. Enter the schedules and setpoints into the system. Provide the required number of input/output points to achieve the specified sequences of operation and monitoring points.
5. Work with the Owner to determine which points shall be trended and the sampling frequency. Set up the trend logs in the BAS.

B. Ductless Split System Unit Control (AC-1/ACC-1):

1. The unit shall be controlled by its factory controls. Mount and wire the thermostat, which is furnished by the equipment manufacturer, and interlock the controls from the indoor unit to the outdoor unit. Set to maintain 75°F, adjustable.
2. Provide a space mounted temperature sensor for monitoring and alarm generation at the OWS. On a rise in space temperature above the programmed high limit setpoint of 80°F, adjustable, an alarm shall be activated. On a fall in space temperature below the programmed low limit setpoint of 50°F, adjustable, an alarm shall be activated.
3. The following items shall be displayed at the OWS:
   a. Space temperature.
   b. High and low limit alarms and setpoints.

C. Split System Heat Pump System Control (HP-1 &2/ACCHP-1)

1. The sequence that follows is for the multi-joint heat pump system shown on the drawings.
2. Mount and wire the System Controller furnished by the system manufacturer in a location as directed by the Owner. Extend control wiring from the Controller to all heat pump units within the system.
3. Interface each heat pump unit with its respective wall mounted temperature control furnished with each unit.
4. The System Controller shall activate the heat pump units according to its programmed occupied/unoccupied schedule. Set room temperature control for each heat pump unit to maintain occupied space temperature at 70°F, adjustable, in the heating mode, and 75°F, adjustable, in the cooling mode. Program unoccupied setpoints as directed by the Owner.
5. The System Controller shall provide full overview display, list all rooms connected to the system, monitor all room conditions, and monitor all heat pump unit configuration settings. Interface the system controller with the OWS for all monitoring and alarm capability. Coordinate with those points selected by the Owner.
6. For units mounted horizontally above finished ceilings, provide a water detector in the bottom of the auxiliary drain pan located under each unit. Upon sensing water in the pan, the unit shall stop and the controller shall initiate an alarm to the OWS.

D. Kitchen Hood Exhaust Fan & Make-Up Air Unit Control (EF-1 and MAU-1)

1. The hood exhaust fan and make-up air unit shall be energized automatically by temperature sensor(s) provided as part of the hood. Interface with these sensor(s) in accordance with hood manufacturer's written instructions.
2. The kitchen equipment manufacturer shall provide the BAS Contractor with wiring diagrams for the hood.
3. The following items shall be provided by the make-up air unit manufacturer:
   a. Motor starter and overload protection.
   b. Outside air damper and actuator.
   c. Terminal blocks for all wiring connections between equipment and control devices.
   d. Remote discharge air temperature setpoint controller.
4. Provide a current sensor on one phase of the power feeding the exhaust fan. When current is sensed, indicating that the exhaust fan has been energized, the make-up air unit outside air damper shall open 100% and the supply fan shall be energized. On a fall in discharge air temperature

below setpoint of 65°F, adjustable, the gas heat shall stage and modulate through its unit-mounted controls to maintain setpoint.

5. Provide a current sensor on one phase of power feeding the supply fan for monitoring and alarm generation at the OWS.
6. The system shall prevent the circulation of smoke. Upon activation of the duct smoke detector in the supply air duct at the discharge of MAU, the unit shall stop and all dampers shall close.
   a. The Mechanical Contractor shall install duct smoke detector furnished as part of the work of Division 26 – Electric.
7. Interface with a common fire alarm input to the BAS system from the fire alarm system (FAS). The fire alarm contact shall be provided by the fire alarm system vendor at the FAS panel. The status of the alarm contact shall be communicated throughout the BAS. When the fire alarm contact indicates an alarm condition, the BAS shall de-energize the supply fan, exhaust fan, gas heat and damper motors. When de-energized, the damper motor shall spring return the outside air damper closed.
   a. If the kitchen ventilator exhaust fan is running and the hood fire suppression system is activated manually, the exhaust fan shall continue to run until deactivated by the FAS or manually shut down at the hood.
   b. MAU shall shut down whenever the hood suppression system or fire alarm system is activated. Provide interface with each system.
8. The following items shall be displayed at the OWS:
   a. Discharge air temperature.
   b. Discharge air temperature setpoint.
   c. Discharge low limit alarm.
   d. Fire alarm system status alarm.
   e. Commanded status of fans.
   f. Supply fan operational status via current sensor.
   g. Exhaust fan operational status via current sensor.
   h. Smoke detector status/alarm.
   i. Diagram showing the layout of the equipment with major components and dynamic temperatures shown where temperature sensors exist in the system.

E. Rooftop Energy Recovery Unit Control (ERU-1):

1. The unit consists of a supply fan, exhaust fan, packaged DX cooling system with hot gas reheat, package indirect fired gas heating system, energy recovery wheel and drive, filters, air control dampers and actuators, VFD's for each fan, and unit controls.
2. The shall be controlled by an individual DDC Controller. The DDC Controller shall be wired to sensors which shall include, but are not limited to, a discharge air temperature sensor, exhaust air temperature sensor, return air temperature sensor, outside air temperature sensor.
3. The BAS Contractor shall furnish required sensing and control devices to the unit manufacturer for factory installation and wiring. The equipment manufacturer shall provide the BAS Contractor with wiring diagrams for the equipment. The BAS Contractor shall then provide wiring diagrams to the equipment manufacturer detailing installation and wiring requirements for the DDC Controls.
4. The occupied/unoccupied schedule shall correspond to the occupancy schedule as directed by

Owner. Delay startup of the unit until the zone temperature has recovered from its previous setback or setup temperature during the unoccupied mode.

5. Once activated, supply fan, exhaust fan, and energy recovery wheel shall run continuously with the outside air and exhaust air dampers open. The gas fired heating section shall modulate to maintain the minimum discharge air temperature setpoint of 70 degrees F, adjustable. On a rise in discharge air temperature, the DX cooling system shall be staged to maintain a cooling discharge air temperature setpoint of 55 degrees F, adjustable. On a fall in temperature the reverse shall occur.
   a. Whenever the supply air duct humidity level exceeds 60%, adjustable, the unit control shall activate the modulating hot gas reheat section to reduce this condition to 50%, adjustable.
   b. When the unit is deactivated, the fans, heating and cooling shall be off and all dampers shall be closed.
6. The DDC controller shall receive input from the unit's factory installed energy wheel rotation sensor for monitoring and alarm generation at the OWS.
   a. Unit shall continue to run in manual mode until the unit is shut down manually or at the OWS whenever the energy wheel fails.
   b. Whenever the outside air temperature is +/- 5°F, adjustable, of return air temperature in the unit, the energy recovery wheel shall stop.
7. Interface with a common fire alarm input from the fire alarm system. The fire alarm contact shall be provided at the fire alarm panel by the fire alarm contractor. The status of the alarm contact shall be communicated throughout the BAS. When the fire alarm contact indicates an alarm condition, the BAS shall de-energize the unit. When de-energized, the damper motors shall spring return the outside and exhaust air dampers closed. Provide an alarm at the OWS to indicate fire alarm status.
8. The following items shall be displayed at the OWS:
   a. Discharge air temperature.
   b. Discharge air temperature setpoint.
   c. Return air temperature.
   d. Exhaust air temperature.
   e. Fire alarm system status alarm.
   f. Commanded status of fans.
   g. Supply fan operational status via a current sensor.
   h. Exhaust fan operational status via a current sensor.
   i. Energy recovery wheel commanded status and alarm.
   j. Diagram showing the layout of the equipment with major components and dynamic temperatures shown where temperature sensors exist in the system.

F. Packaged Rooftop Unit Control: (RTU-1)
1. This unit consists of a supply fan, packaged air-cooled DX cooling system, gas fired heating section, air filters, air control dampers and actuators, and unit controls.
   a. The unit is a constant volume system with minimum outside air and economizer mode of operation.
   b. The unit shall be controlled by an individual DDC Controller. The DDC Controller shall be wired to sensors which shall include, but are not limited to, a discharge air temperature

sensor, mixed air temperature sensor, return air temperature sensor, return air humidity sensor, global outside air temperature/humidity/enthalpy, CO2 sensors, and space temperature sensors. Provide additional temperature sensors for zone averaging control.

2. The following items shall be provided by the equipment manufacturer:
   a. Motor starters and overload protection.
   b. Control transformers.
   c. Dampers and damper motors.
   d. Terminal blocks for all wiring connections between equipment and control devices.
   e. Standard factory control modules for all unit functions.

   The following items shall be provided by ATC.
   a. Discharge air temperature sensor.
   b. Return air temperature and humidity sensors.
   c. Global outside air temperature and humidity sensors.
   d. Current sensor for one phase of the power feeding the fan.
   e. Mixed air average temperature sensor.
   f. CO2 sensors and space temperature sensors.
   g. DDC Controller.
3. During the programmed occupied mode, the supply fan shall run continuously with the outside air damper closed. When fan fails to start once activated, initiate an alarm to the system after a twenty second delay. Monitor fan status with a current sensor on one leg of power feeding the fan motor. Delay opening the outside air damper to its minimum position until the zone space temperature has recovered from the setback or setup temperature setting.
   a. Outside air damper shall remain closed until return air CO2 level rises to 700 ppm. The outside air damper shall step open from the closed to full scheduled open position to maintain CO2 level at or below 700 ppm. The return air and relief air dampers in the system shall modulate in unison to maintain the balance of air in the system.
   b. On a continued rise in CO2 level above 900 ppm, activate an alarm at the OWS. On a decrease in CO2 level below 700 ppm, the outside air damper shall step closed.
4. On a drop in space air temperature below the programmed setpoint of 70°F, adjustable, the unit gas heating section shall be activated through its unit controls and modulate to maintain setpoint.
5. On a rise in space air temperature above setpoint, the mixing box economizer sequence shall be activated. On a further rise or if the economizer sequence is deactivated, the unit air-cooled DX system hall be activated through its unit controls to maintain setpoint. On a fall in temperature the reverse shall occur. Maintain 75°F, adjustable.
6. The mixing box economizer sequence shall be activated as the first stage of cooling. The DDC Controller shall receive input from the global outside air temperature and humidity sensors to calculate outside air enthalpy. If the outside air enthalpy is at 25 BTU/lb, adjustable, the mixing box dampers shall modulate to maintain the mixed air temperature setpoint of 55°F, adjustable. The outside air damper shall continue to open up to 100% outside air to satisfy cooling demand. The return/relief dampers in the unit shall move in unison to maintain the balance of air in the unit. The outside air damper shall not close below the minimum position during the occupied period.
7. During the programmed un-occupied mode, the fan, heating, cooling and mixing box dampers

shall be cycled/modulated to maintain the un-occupied setpoints of 60°F (heating) and 85°F (cooling), all adjustable. Unless required for economizer cycle, the outside air and relief air dampers shall remain closed with the return air damper fully open.

8. Interface with a common fire alarm input from the fire alarm system. The fire alarm contact shall be provided at the fire alarm panel by the Fire Alarm Contractor. The status of the alarm contact shall be communicated throughout the BAS. When the fire alarm contact indicates an alarm condition, the BAS shall de-energize the unit. When de-energized, the damper motors shall spring return all air dampers closed. Provide an alarm at the OWS to indicate fire alarm status.
9. The Mechanical Contractor shall install duct smoke detectors in the supply and return air ducts at the unit as furnished by the FAS vendor as part of the work of Division 26 – Electric. When wired to the fire alarm system as required by the Division 26 contractor, the duct smoke detectors shall alarm the FAS, which shall signal the BAS to de-energize the unit in a manner similar to item 8.
10. The following items shall be displayed at the OWS:
    a. Discharge air temperature and humidity.
    b. Discharge air temperature and humidity setpoint.
    c. Space air temperature.
    d. Space air temperature setpoint.
    c. Return air temperature and humidity.
    f. Return air temperature and humidity setpoint.
    g. Mixed air temperature.
    h. Mixed air temperature setpoint.
    i. Global outside air temperature, humidity and enthalpy.
    j. Fire alarm system status/alarm.
    k. Duct smoke detectors status: normal/alarm.
    l. Commanded status of fan.
    m. Supply fan operational status via current sensor.
    n. Diagram showing the layout of the equipment with major components and dynamic temperatures shown where temperature sensors exist in the system

G. Packaged Rooftop Unit Control: (RTU-2)

1. This unit consists of a supply fan, packaged air-cooled DX cooling system, gas fired heating section, air filters, air control dampers and actuators, supply fan VFD (for balancing) and unit controls.
    a. The unit is a constant volume system with minimum outside air and economizer mode of operation with powered relief air fan.
    b. The unit shall be controlled by an individual DDC Controller. The DDC Controller shall be wired to sensors which shall include, but are not limited to, a discharge air temperature sensor, mixed air temperature sensor, return air temperature sensor, return air humidity sensor, global outside air temperature/humidity/enthalpy, and space temperature sensor. Provide additional temperature sensors for zone averaging control.
2. The following items shall be provided by the equipment manufacturer:
    a. Motor starters and overload protection.
    b. Control transformers.

c. Dampers and damper motors.

d. Terminal blocks for all wiring connections between equipment and control devices.

e. Standard factory control modules for all unit functions.

The following items shall be provided by ATC.

a. Discharge air temperature sensor.

b. Return air temperature and humidity sensors.

c. Global outside air temperature and humidity sensors.

d. Current sensor for one phase of the power feeding each fan.

e. Mixed air average temperature sensor.

f. Space temperature sensor.

g. DDC Controller.

3. During the programmed occupied mode, the supply fan shall run continuously with the outside air damper open to minimum position. When fan fails to start once activated, initiate an alarm to the system after a twenty second delay. Monitor fan status with a current sensor on one leg of power feeding the fan motor. Delay opening the outside air damper to its minimum position until the zone space temperature has recovered from the setback or setup temperature setting.

4. On a drop in space air temperature below the programmed setpoint of 70°F, adjustable, the unit gas heating section shall be activated through its unit controls and modulate to maintain setpoint.

5. On a rise in space air temperature above setpoint, the mixing box economizer sequence shall be activated. On a further rise or if the economizer sequence is deactivated, the unit air-cooled DX system hall be activated through its unit controls to maintain setpoint. On a fall in temperature the reverse shall occur. Maintain 75°F, adjustable.

   a. Whenever the supply air duct humidity level exceeds 60%, adjustable, the unit control shall activate the modulating hot gas reheat section to reduce this condition to 50%, adjustable.

6. The mixing box economizer sequence shall be activated as the first stage of cooling. The DDC Controller shall receive input from the global outside air temperature and humidity sensors to calculate outside air enthalpy. If the outside air enthalpy is at 25 BTU/lb, adjustable, the mixing box dampers shall modulate to maintain the mixed air temperature setpoint of 55°F, adjustable. The outside air damper shall continue to open up to 100% outside air to satisfy cooling demand. A limit switch on the outside air damper shall activate the unit powered relief air fan to maintain the balance of air in the unit during economizer operation. The return air damper in the unit shall move in unison with the outside air damper to maintain the balance of air in the unit. The outside air damper shall not close below the minimum position during the occupied period.

7. During the programmed un-occupied mode, the fan, heating, cooling and mixing box dampers shall be cycled/modulated to maintain the un-occupied setpoints of 60°F (heating) and 85°F (cooling), all adjustable. Unless required for economizer cycle, the powered relief air fan shall remain off, the outside air and relief air dampers shall remain closed with the return air damper fully open.

8. Interface with a common fire alarm input from the fire alarm system. The fire alarm contact shall be provided at the fire alarm panel by the Fire Alarm Contractor. The status of the alarm contact shall be communicated throughout the BAS. When the fire alarm contact indicates an alarm condition, the BAS shall de-energize the unit. When de-energized, the damper motors shall spring return all air dampers closed. Provide an alarm at the OWS to indicate fire alarm status.

9. The Mechanical Contractor shall install duct smoke detectors in the supply and return air ducts at

the unit as furnished by the FAS vendor as part of the work of Division 26 – Electric. When wired to the fire alarm system as required by the Division 26 contractor, the duct smoke detectors shall alarm the FAS, which shall signal the BAS to de-energize the unit in a manner similar to item 8.

10. The following items shall be displayed at the OWS:
    a. Discharge air temperature and humidity.
    b. Discharge air temperature and humidity setpoint.
    c. Space air temperature.
    d. Space air temperature setpoint.
    c. Return air temperature and humidity.
    f. Return air temperature and humidity setpoint.
    g. Mixed air temperature.
    h. Mixed air temperature setpoint.
    i. Global outside air temperature, humidity and enthalpy.
    j. Fire alarm system status/alarm.
    k. Duct smoke detectors status: normal/alarm.
    l. Commanded status of each fan.
    m. Supply fan operational status via current sensor.
    n. Relief fan operational status via current sensor.
    o. Diagram showing the layout of the equipment with major components and dynamic temperatures shown where temperature sensors exist in the system

H. Cabinet Unit Heater Control (ECH-1)
1. Cabinet unit heater shall be controlled by the BAS via a space temperature sensor.
    a. Provide a separate DDC controller and flat plate space sensor; no override switch is required.
2. The unit fan shall cycle to maintain the programmed setpoint of 65°F, adjustable.
3. Provide a current switch on one phase of power feeding the unit fan for status indication at the OWS.
4. The following items shall be displayed at the OWS:
    a. Space temperature
    b. Space temperature setpoint
    c. Commanded status of fan
    d. Operational status of fan via current switch

I. Electric Panel Radiation Heater Control (EFR)
1. Provide control voltage relay for each unit for activation through the OWS based on the owner's occupancy schedule.
2. Provide a wall mounted temperature sensor with guard to control all heaters. Set to maintain 65°F during the occupied mode and 55°F during the unoccupied mode.
3. Provide space temperature and unit status as indications to the system.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install system and materials in accordance with manufacturer's instructions and roughing-in drawings,

and details and drawings. Install electrical work and use electrical products complying with requirements of these specifications. Mount controllers at convenient locations and heights.

B. All wiring shall be properly supported and run in a neat and workmanlike manner. All wiring exposed and in equipment rooms shall run parallel to or at right angles to the building structure. All wiring within enclosures shall be neatly bundled and anchored to prevent obstruction to devices and terminals. All wiring shall be in accordance with all local and national codes. Low voltage wiring for space temperature sensors, communication bus between terminal units, etc., above accessible ceilings in finished spaces on the floors may be plenum rated cable. Wiring in all locations shall be installed in EMT conduit. All electronic wiring shall be #18 AWG minimum THHN and shielded if required, except standard network (Ethernet, LonWorks, etc.) cabling shall be as tested and recommended in lieu of #18 gauge twisted, #22 or #24 gauge is acceptable if used as a part of an engineered structured cabling system. The control manufacturer must submit technical and application documentation demonstrating that this cabling system has been tested and approved for use by the manufacturer of both the control system and the engineered structured cabling system.

C. Provide all sensing, control, and interlock wiring for the following:

System inputs and outputs

System communications

System power

System interlocks

Unit controls

D. The Control Manufacturer shall enter all computer data into the Host computer including all graphics, control programs, initial approved parameters and settings, and English descriptors. The Control Manufacturer shall maintain diskette copies of all data file and application software for reload use in the event of a system crash or memory failure. One copy shall be delivered to the owner during training sessions, and one copy shall be archived in the Control Manufacturer's local software vault.

3.2 DATA CONTROL (D/C) AND GRAPHICS SUMMARY

A. All hardware, custom software, application software, graphics, etc., necessary to accomplish the control sequences and display the graphics specified shall be provided as part of this contract. Provide all controllers, inputs, outputs, valves, dampers, actuators and flow meters required to provide the control and graphic data described. Provide software setpoints required for display in logical groups and graphics.

B. Each digital output shall have a software-associated monitored input. Any time the monitored input does not track its associated command output within a programmable time interval, a "command failed" alarm shall be reported.

C. Where calculated points (such as CFM) are shown, they shall appear in their respective logical groups.

D. Unless otherwise specified or approved prior to bidding, the primary analog input and the analog output of each DDC loop shall be resident in a single remote panel containing the DDC algorithm, and shall function independent of any primary or UC communication links. Secondary (reset type) analog inputs may be received from the primary network, but approved default values and/or procedures shall be substituted in the DDC algorithm for this secondary input if network communications fail or if the secondary input becomes erroneous or invalid.

3.3 ACCEPTANCE

A. The Control Manufacturer shall completely check out, calibrate and test all connected hardware and software to insure that the system performs in accordance with the approved specifications and sequences of operations approved.

B. Witnessed acceptance demonstration shall display and demonstrate each type of data entry to show site specific customizing capability; demonstrate parameter changes; execute digital and analog commands; and demonstrate DDC loop stability via trend of inputs and outputs.

3.4 MANUALS

A. The following manuals will be provided:

1. An Operators Manual shall be provided with graphic explanations of keyboard use for all operator functions specified under Operator Training.

B. Computerized printouts of all GPC data file including all point processing assignments, physical terminal relationships, scales and offsets, command and alarm limits, etc.

C. A manual shall be provided including revised as-built documents of all materials required under the paragraph "SUBMITTALS" on this specification.

D. Two Operators Manuals, and two As-Built Manuals shall be provided to the owner.

3.5 TRAINING

A. All training shall be by the BMCS contractor and shall utilize operators manuals and as-built documentation.

B. Operator training shall include three (3) four-hour sessions encompassing modifying text and graphics, sequence of operation review, selection of all displays and reports, use of all specified OWS functions, troubleshooting of sensors (determining bad sensors), and password assignment and modification. One training session shall be conducted at system completion, one shall be conducted forty-five days after system completion, and one at ninety (90) days, or as requested by the Owner.

3.6 SERVICE GUARANTEE

A. The control system herein specified shall be free from defects in workmanship and material under normal use and service. After completion of the installation, the control manufacturer shall regulate and adjust all thermostats, control valves, motors and other equipment provided under this contract. If within twelve (12) months from date of acceptance either for beneficial use of final acceptance, whichever is earlier, any of the equipment herein described is proven to be defective in workmanship or materials, it will be replaced or repaired free of charge. The control manufacturer shall, after acceptance, provide any service incidental to the proper performance of the control system under guarantee outlined above for the period of one year. Normal maintenance of the system or adjustments of components is not to be considered part of the guarantee. The control manufacturer will upon completion of the installation, during the warranty period, make available to the Owner, an annual service agreement covering all labor and material required to efficiently maintain the control system.

3.7 FINAL ADJUSTMENT

A. After completion of installation, adjust thermostats, control valves, motors and similar equipment provided as work of this section.

B. Final adjustment shall be performed by specially trained personnel in direct employ of installer of primary temperature control system.

END OF SECTION

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SECTION 23 10 00
FACILITY FUEL SYSTEMS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including the Conditions of the Contract (General, Supplementary and other Conditions, if any) and Division 1 as appropriate, apply to the work specified in this Section.

1.2 DESCRIPTION OF WORK

A. This Section includes:

1. Natural gas piping system as indicated on drawings and schedules, and by requirements of this section.
2. Applications for natural gas piping systems include the following:
   a. Elevated pressure (psi) gas from meter location to gas-fired equipment.
   b. Low pressure (WC) from the gas regulator location equipment and outlets, requiring gas service.

1.3 REFERENCE STANDARDS

A. Refer to Section 22 00 00 for a general description of requirements applying to this Section.

1.4 QUALITY ASSURANCE

A. Refer to Section 22 05 00 for a general description of requirements applying to this section.

1.5 SUBMITTALS

A. Submit shop drawings and product data in accordance with Section 22 00 00.

B. Submit the following:

1. Product data on gas valves.

1.6 WARRANTY/GUARANTEE

A. All work and materials are subject to the general warranty as described in the General Conditions of the Contract and in Division 1, GENERAL REQUIREMENTS.

PART 2 – PRODUCTS

2.1 NATURAL GAS PIPING MATERIALS AND PRODUCTS

A. Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide materials and products complying with ANSI B31.2 where applicable, base pressure rating on natural gas piping system maximum design pressures. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match piping materials used in natural gas piping systems. Where more than 1 type of material or product is indicated, selection is Installer's option.

2.2 BASIC IDENTIFICATION

A. Provide identification complying with Division 22 Sections and in accordance with the following listing:

Building Distribution Piping: Plastic pipe markers.

Gas Service: Underground type plastic line markers with detectable wire.

Gas Valves: Plastic valve tags.

2.3 BASIC PIPE, TUBE AND FITTINGS

A. Provide pipe, tube and fittings complying with Section 22 05 00 Common Work Results for Plumbing and in accordance with the following listing:

1. Interior Piping: Schedule 40 black steel ASTM A-53, A-106

   Fittings: Malleable black iron, threaded

2. Exterior Below Grade Piping: Medium-density polyethylene pipe.
3. Exterior Exposed or Roof Top Piping: Schedule 40 black steel with weather coating.

   Fittings: Wrought steel, butt welded.

2.4 BASIC PIPING SPECIALTIES

A. Provide piping specialties complying with applicable Division 22 Sections and in accordance with the following listing:

Pipe escutcheons

Pipe sleeves

Sleeve seals

2.5 SPECIAL VALVES

A. Valves required for gas piping systems on this project shall be the following types:

<u>Gas Valves: (Up to 3”)</u>

1. Apollo 80-100 Series bronze gas ball valve. Threaded, 600 PSIG WOG, cold non-shock. 250 PSIG LP-Gas. 150 PSIG saturated steam. Vacuum service to 29 inches Hg. Federal Specification: WW-V-35C, Type: II, Composition: BZ, Style: 3.
2. Features:

   - UL Listed for LP-Gas and natural gas.
   - Large ports to reduce pressure drop
   - Reinforced TFE seats and seals
   - Blow-out-proof stem design
   - Optional tee handle available
   - Quarter turn on-off
   - Adjustable packing gland
   - One piece bronze body
   - Chromium plated ball

3. UL Listings:

   - Guide YSDT: LP-Gas shut-off valve.
   - Guide YRPV: Gas shut-off valve for use with natural and manufactured gases.

4. This valve shall be used for all pipe sizes up to 3” in the system.

<u>Gas Valves (4” and Larger)</u>

1. Apollo 88A-100 Series carbon steel, ANSI Class 150 flanged standard port ball valves.

   Standards of Compliance:

   IFGC: Section 409 (Valves)

   ASME B16.5 – Pipe Fittings and Flanges

ASME B16.33 – Manual Operated Metal Gas Valves up to 125 psig

ASME B16.38 – Large Metal Valve Gas Distribution

ASME B31.8 – Gas Transmission and Distribution Piping Systems

UL 125

B. Manufacturers: Subject to compliance with requirements, provide gas valves of one of the following:

Apollo/Conbraco

Stockham

Milwaukee

NIBCO, Inc.

Watts

2.6 GAS PRESSURE REGULATORS

A. ANSI Z21.18, single-stage, steel-jacketed, corrosion-resistant pressure regulators. Include atmospheric vent, elevation compensator, with threaded ends conforming to ASME B1.20.1 for 2-inch NPS and smaller and flanged ends for 2-1/2" NPS and larger. Regulator pressure ratings, inlet and outlet pressures, and flow volume in cubic feet per hour of natural gas at specific gravity are as indicated.

1. Service Pressure Regulators: Inlet pressure rating not less than natural gas distribution system service pressure.
2. Line Gas Pressure Regulators: Inlet pressure rating not less than system pressure.
3. Appliance Gas Pressure Regulators: Inlet pressure rating not less than system pressure.
4. Gas Pressure Regulator Vents: Factory or field installed corrosion-resistant screen in opening when not connected to vent piping.
5. Regulators shall be as manufactured by Sensus (no equal substitute permitted).

PART 3 – EXECUTION

3.1 INSTALLATION OF BASIC IDENTIFICATION

A. Install mechanical identification in accordance with applicable Division 22 Sections.

3.2 INSTALLATION OF NATURAL GAS PIPING (INTERIOR)

A. Install natural gas distribution piping in accordance with Section 22 05 00 Common Work Results for Plumbing and in accordance with applicable codes IFGC latest edition, and local Utility Company requirements.

B. Use sealants on metal gas piping threads which are chemically resistant to natural gas. Use sealants sparingly, and apply to only male threads of metal joints.

C. Remove cutting and threading burrs before assembling piping.

D. Do not install defective piping or fittings. Do not use pipe with threads which are chipped, stripped or damaged.

E. Plug each gas outlet, including valves, with threaded plug or cap immediately after installation and retain until continuing piping or equipment connections are completed.

F. Install drip-legs in gas piping where indicated, and where required by code or regulation.

G. Install "Tee" fitting with bottom outlet plugged or capped at bottom of pipe risers.

H. Use dielectric unions where dissimilar metals are joined together.

I. Install piping with 1" drop in 60' pipe run (0.14%) in direction of flow.

J. Install piping parallel to other piping, but maintain minimum of 12" clearance between gas piping and steam or hot water piping above 200 degrees F (93 degrees C).

K. For piping buried in building substrate, or below floor slabs, install in welded conduit, ventilated to outdoors on both ends, and tested to same requirements as gas piping.

L. Gas valves shall not be installed above ceilings without access and signage.

M. Supports:

1. All pipe, fittings, valves, installation and testing shall be in accordance with the IFGC, Chapter 4.
2. Gas piping shall be supported in accordance with the International Fuel Gas Code's latest accepted 2003 Edition, Section 407, as follows:
3. Support intervals shall be in accordance with the IFGC listed above and in Section 415, Table 415.1 as follows:
   a. Steel pipe ½" nominal size – not to exceed 6 ft.
   b. Steel pipe ¾" to 1" nominal size – not to exceed 8 ft.
   c. Steel pipe 1-1/4" and larger nominal size horizontal – not to exceed 10 ft.
   d. Steel pipe 1-1/4" and larger nominal size, vertical not to exceed every floor.
4. Support and spacing of CSST Systems shall be in accordance with CSST manufacturer's instructions.

3.3 INSTALLATION OF VALVES

A. Gas valves: Provide at connection to gas train for each gas-fired equipment item; and on risers and branches where indicated.

B. Locate gas valves where easily accessible, and where protected from possible damage.

3.4 EQUIPMENT CONNECTIONS

A. Connect gas piping to each gas-fired equipment item, with drip leg, union and shutoff gas valve. Comply with equipment manufacturer's instructions. Drip legs shall not be installed on any exterior gas piping.

B. Equipment furnished by the Owner, or Contractors other than this Contractor: After equipment has been set in place, this Contractor shall furnish all labor and material required to make final connections between roughing-in and the equipment. Install valves, fittings, trim and appurtenances furnished with the equipment. Piping shall be of the same material as the system to which it connects.

C. All rooftop, gas-fired equipment shall be provided with gas pressure regulating valve to reduce gas pressure from 5 psi to 7" WC. All regulators shall be provided with relief vent discharge piping of lengths as required for minimum distance of equipment air intake grilles.

3.5 INSTALLATION OF GAS PRESSURE REGULATORS

A. This Contractor shall furnish and install gas pressure regulating valves for all shown on the drawings. Installation shall be in strict accordance with the requirements of the Utility Company and the Canadian Gas Association.

B. All regulators installed shall be tagged with data noting the inlet and outlet pressure for each individual regulator installed.

C. Medium or High Pressure (MP) (HP) Regulators shall comply with the following:

1. The MP regulator shall be approved and shall be suitable for the inlet and outlet gas pressures for the application.
2. The MP regulator shall maintain a reduced outlet pressure under lockup (no flow) conditions.

3. The capacity of the MP regulator, determined by published ratings of its manufacturer, shall be adequate to supply the appliances served.
4. The MP pressure regulator shall be provided with access. Where located indoors, the regulator shall be vented to the outdoors or shall be equipped with a leak-limiting device, in either case complying with Section 410 of the IFGC.
5. A tee fitting with one opening capped or plugged shall be installed between the MP regulator and its upstream shutoff valve. Such tee fitting shall be positioned to allow connection of a pressure-measuring instrument and to serve as a sediment trap.
6. A tee fitting with one opening capped or plugged shall be installed not less than 10 pipe diameters downstream of the MP regulator outlet. Such tee fitting shall be positioned to allow connection of a pressure-measuring instrument.

3.6 EXTERIOR GAS PIPING

A. All rooftop or exterior gas piping shall be weatherproof with and epoxy resin approved by the Gas Company.

B. Uncoated, threaded or socket welded joints shall not be used in piping in contact with soil or where internal or external service corrosion is known to occur.

C. Protective Coatings and Wrapping: Pipe protective coatings and wrappings shall be approved for the application and shall be factory applied.

OR

C. In lieu of coated steel pipe, the Contractor may use high grade material, physical and mechanical properties as classified in accordance to ASTM D 3350 and cell classification of 234373E plastic pipe and fittings for underground use only, and shall conform with ASTM D-2513. Pipe shall be marked "GAS" and "ASTM D-2513". Only Contractors registered and/or certified for installation of underground or below-grade plastic piping shall be permitted to install this material on this project.

D. Detectable underground warning tape shall read ("CAUTION – BURIED GAS LINE BELOW"). Printed on APWA approved colors, minimum 2" wide, 5 mil tape with aluminum backing for using non-ferrous locator.

OR

A. All exterior gas pipe and fittings installed, including all welded joints, shall be provided with weatherproof coatings. The coatings shall be a two-layer PE "Pritec" coating as manufactured by Liberty Coating. The coatings shall be Butyl rubber adhesive with a polyethylene topcoat.

B. Component Properties:

Adhesive

Polyethylene

ADHESIVE		
Softening Point	ASTM E28	190°F
Water Absorption	ASTM D570	<0.1%
Adhesive		Compounded Butyl Rubber

POLYETHYLENE		
Color		Black
Density	ASTM D1505	>0.950

Elongation	ASTM D638	>600%
Tensile Strength	ASTM D638	>2,800 psi
Outdoor Exposure		>2 years
Hardness, Shore D	ASTM D2240	>60

PRITEC®		
Operating Temperature		-40°F to +180°F
*Peel Strength	ASTM D1000	>20 lbs lineal
Field Bending	Arctic Service Equipment	1.9 deg. per pipe dia.
Water Absorption	ASTM D570	0.06%
Impact Resistance	ASTM G14	33.65 in/lbs (10/40 sys.)
Volume Resistivity	ASTM D257	$10x10^{16}$ Ohm cm
Dielectric Strength	ASTM D149 @73°F	700 Volts/Mil
Cathodic Disbondment	1.5v/3%/70°F/24 Hrs.	6 mm radiius

END OF SECTION

SECTION 23 23 00
REFRIGERATION PIPING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the contract, including the conditions of the contract (General, Supplementary and other Conditions, if any) and Division 1 as appropriate, apply to the work specified in this section.

B. Refer to Section 23 00 00 for HVAC General Provisions

C. Refer to Section 23 05 00 for HVAC Basic Materials & Methods.

1.2 DESCRIPTION OF WORK

A. This Section includes labor, material, equipment and supervision to for the following:

1. Condensing Unit (Less than 10 Tons)
2. Condensing Unit (10 to 20 Tons)
3. Ductless Split System Cooling Unit
4. Ductless Split System Heat Pump Units

B. Provide complete refrigeration system including chillers, cooling towers, underground pre-insulated pre-fabricated piping, aboveground piping and all required accessories.

1.3 REFERENCE STANDARDS

A. Refer to Section 23 00 00 for a general description of requirements applying to this section.

B. Comply with applicable provisions of:

1. International Mechanical Code
2. ASME Codes for Pressure Vessels
3. A.R.I. Capacity Ratings
4. NFPA Pamphlets
5. ASHRAE Standard 15
6. ASHRAE Standard 90.1, Section 6, Table 6.8.1A thru J, minimum equipment efficiency.

1.4 QUALITY ASSURANCE

A. Refer to Section 23 05 00 for a general description of requirements applying to this Section.

B. Whenever a variable frequency PWM drive is installed to control an AC motor, a maintenance-free, circumferential, conductive micro fiber shaft grounding ring shall be installed on the AC motor drive end to discharge shaft currents to ground. Recommended part: AEGIS SGR™ Bearing Protection Ring, as made by Electro Static Technology. Install in accordance with the manufacturer's written instructions.

C. Verification of Fluid Cooler Performance:

1. Manufacturer shall have a thermal performance testing program for water cooling towers certified by the Cooling Technology Institute (CTI) in accordance with CTI Specification Standard STD-201. Manufacturer's performance guarantees or performance bonds shall also be accepted.
2. Unit Sound Performance ratings shall tested and certified according to CTI ATC-128 standard. Sound ratings shall not exceed specified ratings.

1.5 SUBMITTALS

A. Submit shop drawings and product data in accordance with Section 23 00 00.

B. Submit the following:

1. Shop drawings and product data for all equipment in this section.
2. 1/4" = 1'-0" scale layout of all equipment in Mechanical Room.

1.6 SUBSTITUTIONS

A. The listed equivalent or substituted manufacturers along with the bidding related contractor shall be completely responsible to comply with all requirements on all contract documents. This shall include, but not be limited to, space requirements, code clearances, the type, horsepower, capacities, number and size of services required from other trades, including all required ancillary items furnished and installed by other trades. If the manufacturer or related bidding contractor does not comply with these requirements, this Contractor shall be responsible for any and all additional costs associated with the changes required by other trades.

1.7 WARRANTY/GUARANTEE

A. All work and materials are subject to the general warranty as described in the General Conditions of the Contract and in Division 1, General Requirements. In addition, the following special guarantee applies:

1. Manufacturer shall guarantee all refrigeration equipment including parts and labor, for five (5) years from start-up.

PART 2 – PRODUCTS

2.1 CONDENSING UNIT (Less than 10 Tons)

A. General:

1. Provide air-cooled condensers in accordance with the performance schedule shown on the plans.
2. Install them as shown on the plans in accordance with:
   - The manufacturer's recommendations and
   - All applicable national and local codes.
3. UL (CSA) approved.
4. Leak, pressure and functionally tested at the factory to assure a trouble-free start-up after installation.
5. In current production with published literature available to check performance, limitations, specifications, power requirements, dimensions, operation and appearance.

B. Condenser Coils:

1. Shall be draw-thru, with manufacturer’s standard wire guards.
2. Shall be constructed of copper tubes arranged in staggered rows and mechanically expanded into aluminum fins.

C. Condenser Fan Motors:

1. Shall be directly connected to the condenser fans.
2. Shall have permanently lubricated ball bearings.
3. Shall have inherent overload protection.
4. Motors shall be of the permanent split-capacitor type.

5. Condenser fans shall be arranged for vertical discharge of the condenser air, with manufacturer's standard wire guards.

D. The wiring for each unit shall include:

1. A 24-volt temperature control circuit.
2. High and low pressure circuits.
3. Condenser fan motor controls to assure stable operation of ambient temperatures down to 0 degrees F.
4. Condenser fan and compressor contactor.

E. The refrigerant piping for each system shall include:

1. A strainer-drier,
2. A moisture indicating sight glass, and
3. Service access valves.
4. Locking type, tamper resistance caps on all refrigerant access ports.

The strainer-drier and sight glass may be shipped separately for field installation.

F. Manufacturer: Carrier, Lennox, Daikin McQuay, Trane, York.

1. Any listed equivalent manufacturer and the Mechanical Contractor shall be completely responsible to comply with all requirements on the contract documents. This shall include, but not be limited to, space requirements, code clearances, the type, horsepower, capacities, number and size of services required from other trades.

2.2 CONDENSING UNIT (10-20 Tons)

A. General:

1. Furnish air-cooled condensing unit in accordance with the performance schedule shown on the plans.
2. Install them as shown on the plans in accordance with:
   - The manufacturer's recommendations and
   - All applicable national and local codes.
3. UL (CSA) approved.
4. Completely assembled for one-piece shipping and rigging.
5. Leak, pressure and functionally tested at the factory to assure a trouble-free start-up after installation.
6. In current production with published literature available to check performance, limitations, specifications, power requirements, dimensions, operation and appearance.

B. Unit Enclosure:

1. A steel angle frame to provide the rigid support required for shipping, rigging and years of dependable operation.
2. Exterior panels of 18-gauge galvanized sheet steel which have been bonderized and finished with baked enamel to provide a long-lasting quality appearance.
3. Removable panels to provide easy access to all internal components for maintenance, service and adjustment.

C. Each compressor shall be mounted on spring isolators and shall be enclosed in a separate compartment to minimize the transmission of sound and vibration.

D. Condenser Coils:

1. Shall be draw-thru, with manufacturer's standard wire guards.
2. Shall be constructed of copper tubes arranged in staggered rows and mechanically expanded into aluminum fins, and
3. Shall have a separate circuit which will provide at least 19 degrees F of liquid sub-cooling at design conditions.

E. Condenser Fan Motors:

1. Shall be directly connected to the condenser fans,
2. Shall have permanently lubricated ball bearings, and
3. Shall have inherent overload protection.
4. Motors shall be of the permanent split-capacitor type.
5. Condenser fans shall be arranged for vertical discharge of the condenser air, with manufacturer's standard wire guards.

F. The wiring for each unit shall include:

1. A crankcase heater (one per compressor).
2. A 24-volt temperature control circuit.
3. High and low pressure circuits.
4. Condenser fan motor controls to assure stable operation of ambient temperatures down to 0 degrees F.
5. Condenser fan and compressor contactors factory wired to pressure lugs or terminal block for power wiring.
6. Factory mounted and wired fused disconnect switch.

G. The refrigerant piping for each system shall include:

1. A strainer-drier,
2. A moisture indicating sight glass, and
3. Service access valves.
4. Locking type, tamper resistance caps on all refrigerant access ports.

The strainer-drier and sight glass may be shipped separately for field installation.

H. Manufacturers: York, Carrier, Trane, Lennox, Daikin McQuay.

1. Any listed equivalent manufacturer and the Mechanical Contractor shall be completely responsible to comply with all requirements on the contract documents. This shall include, but not be limited to, space requirements, code clearances, the type, horsepower, capacities, number and size of services required from other trades.

2.3 DUCTLESS SPLIT SYSTEM HEAT PUMP UNIT

A. Air conditioning system shall be a ductless split system heat pump. The system shall consist of a compact ceiling-mounted packaged evaporator section and matching outdoor air-cooled condensing unit. The units shall be listed by and bear the ETL label. All wiring should be in accordance with the National Electrical Code (N.E.C.). The units shall be rated in accordance with ARI Standard 240 and bear the ARI label. A full charge of refrigerant for 100 feet of refrigerant tubing shall be provided in the condensing unit. A dry nitrogen holding charge shall be provided in the evaporator. System SEER shall meet or exceed 1992 Federal Standards.

B. The indoor unit shall be factory assembled and wired. The casing fascia shall have a white or gray finish. The evaporator fan shall be an assembly with line flow fans direct driven by a single motor. The supply fan motor shall be multi-speed, permanent-split capacitor type with thermal overload protection and sealed, lifetime bearing. The fan shall be backward curved, centrifugal design, statically and dynamically balanced and run on permanently lubricated bearings. An adjustable guide vane shall be provided with the ability to change the air flow from horizontal to vertical. A motorized air sweep flow louver shall provide an automatic change in air flow by directing the air from side to side for uniform air distribution. Return air shall be filtered by means of an easily removable washable filter.

C. The evaporator coil shall be nonferrous construction with smooth plate fins bonded to copper tubing. The tubing shall have inner grooves for high efficiency heat exchange. All tube joints shall be brazed with phoscopper or silver alloy. The coils shall be pressure tested at the factory. A condensate pan and drain shall be provided under the coil. The unit shall be furnished with integral condensate pump with 27" minimum lift, factory mounted and wired.

D. The unit shall be constructed from galvanized steel that is insulated internally and externally with fire-resistant acoustic insulation.

E. The control system shall be microprocessor based. The wall-mounted remote control enclosure shall include an LCD display providing a continuous display of operating status and condition. An keypad for setpoint/program control, unit ON/OFF, and fan speed shall be located below the display.

1. The auto restart feature shall automatically restart after a power failure.
2. The control shall have temperature control setpoint for cooling function with a minimum 2 deg. F differential. The temperature control setpoint range shall be 60 deg. F to 85 deg. F.
3. The LCD display shall provide an ON/OFF indication, fan speed indication, operating mode indication (cooling, dehumidifying) and current day, time, temperature and humidity (if applicable) indication.

F. Direct Expansion System Components:

1. The evaporative coil shall be constructed of copper tubes and aluminum fins. The coil shall be provided with a drain pan.
2. The refrigeration system shall consist of a hermetic compressor, pressure safety switches, externally equalized expansion valve, and a refrigerant sight glass and moisture indicator.
3. Low ambient control will allow cooling to 0 deg. F outdoor temperature.

G. Remote Air-Cooled Condenser: The condenser coil shall be constructed of copper tubes and aluminum fins, and a direct-drive centrifugal fan. No piping, brazing, dehydration or charging shall be required. Condenser electrical connection shall be by a factory wired plug. Fan shall be sized to provide full rated cooling capacity at 95 deg. F entering air. Provide wire guards on condenser coil and fan discharge.

H. Features:

1. Branch duct knockouts on the sides of the chassis for remote discharge of supply air.
2. Fresh air inlet knockout for connection of ventilation air directly into the unit without the need for an inline booster fan. If the length of ductwork exceeds ten feet, provide a booster fan as scheduled on the drawings.
3. Condensate system shall contain a float switch to automatically shut down the cooling operation if the condensate level reaches an overflow condition.
4. Unit-mounted and wired electric backup heat with manual and automatic thermal cutout switches, for use on heat pump models.

I. Factory installed controls shall include connections for 24-volt, hard-wired, wall-mounted thermostat, control board featuring anti-short cycle timer, 60 second post purge fan relay, on-board 30 AMP electric heat relay, and relays and connectors for condensing unit control. Provide wall-mounted solid state thermostat for field mounting and wiring to the indoor unit; the thermostat shall be capable of one-stage cooling; one-stage cooling, one-stage heating with manual changeover; one-stage cooling, two-stage heating with heat pump operation for the first stage of heat, as scheduled on the drawings.

J. Manufacturers: Samsung, EMI, LG HVAC, Mitsubishi Electric, Panasonic, Sanyo Air Conditioning Products.

1. Any listed equivalent manufacturer and the Mechanical Contractor shall be completely responsible to comply with all requirements on the contract documents. This shall include, but not be limited to, space requirements, code clearances, the type, horsepower, capacities, number and size of services required from other trades.

PART 3 – EXECUTION

3.1 REFRIGERATION EQUIPMENT

A. All equipment to be installed in accordance with manufacturer's recommendations.

3.2 AIR-COOLED CHILLER

A. Install in accordance with manufacturer's recommendations. Unit shall be properly supported and vibration isolated.

3.3 REFRIGERANT GAS DETECTION SYSTEM

A. Install system in accordance with manufacturer’s written instructions.

B. Install sensing lines, alarm lights and horns as shown on the drawings.

C. On high level alarm, system shall shut down boilers and start emergency ventilation system.

END OF SECTION

SECTION 23 23 90

HEAT RECOVERY WITH SIMULTANEOUS HEATING AND COOLING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the contract, including the conditions of the contract (General, Supplementary and other Conditions, if any) and Division 1 as appropriate, apply to the work specified in this section.

B. Refer to Section 23 00 00 for HVAC General Provisions

C. Refer to Section 23 05 00 for HVAC Basic Materials & Methods.

1.2 DESCRIPTION OF WORK

A. This Section includes labor, material, equipment and supervision for the following:

1. Single or Multiple Outdoor Condensing Units
2. Multiple Indoor Ceiling Cassette Cooling Units.

B. Provide complete refrigeration system including condensing units, cooling units, aboveground refrigerant piping, and all required controls and accessories for a complete and operable system.

C. The variable capacity, air conditioning system shall be a split system consisting of ductless evaporators exclusively matched to the outdoor condensing unit.

1.3 REFERENCE STANDARDS

A. Refer to Section 23 00 00 for a general description of requirements applying to this section.

B. Comply with applicable provisions of:

1. International Mechanical Code
2. ASME Codes for Pressure Vessels
3. A.R.I. Capacity Ratings
4. NFPA Pamphlets
5. ASHRAE Standard 15
6. ASHRAE Standard 90.1, Section 6, Table 6.8.1A thru J, minimum equipment efficiency.
7. ISO 9001 and 14001.

1.4 QUALITY ASSURANCE

A. Refer to Section 23 05 00 for a general description of requirements applying to this Section.

B. The units shall be listed by Electrical Laboratories (ETL) and bear the ETL label.

C. All wiring shall be in accordance with the National Electric Code (NEC).

D. The system shall be produced in an ISO 9001 and ISO 14001 facility, which are standards set by the International Standard Organization (ISO). The system shall be factory tested for safety and function.

E. The outdoor unit shall be factory charged for a length of 25 feet of refrigerant with R410A refrigerant.

F. A dry air holding charge shall be provided in the evaporator(s).

G. Provide a letter from the VRF system manufacturer agent certifying completion of Pre-Construction installation training. Certification shall indicate that manufacturer's field piping and wiring recommendation for specified projects have been reviewed prior to installation.

1.5 SUBMITTALS

A. Submit shop drawings and product data in accordance with Section 23 00 00.

B. Submit the following:

1. Shop drawings and product data for all equipment in this section.

2. ¼ " = 1'-0" scale layout of all outdoor equipment adjacent to the building.

1.6 SUBSTITUTIONS

A. The listed equivalent or substituted manufacturers along with the bidding related contractor shall be completely responsible to comply with all requirements on all contract documents. This shall include, but not be limited to, space requirements, code clearances, the type, horsepower, capacities, number and size of services required from other trades, including all required ancillary items furnished and installed by other trades. If the manufacturer or related bidding contractor does not comply with these requirements, this Contractor shall be responsible for any and all additional costs associated with the changes required by other trades.

1.7 WARRANTY/GUARANTEE

A. All work and materials are subject to the general warranty as described in the General Conditions of the Contract and in Division 1, General Requirements. In addition, the following special guarantee applies:

1. Manufacturer shall warrant all refrigeration equipment including parts and labor, for one (1) year from start-up.

2. Compressors shall be warranted for parts only for an additional four (4) years.

PART 2 – PRODUCTS

2.1 GENERAL REQUIREMENTS

A. The system performance shall be in accordance with ARI 210/240 test conditions as shown in the performance table below. System refrigerant piping shall be sized and installed per the manufacturer's piping diagrams and piping procedures.

B. The cooling performance is based on 80°F DB / 67°F WB for the indoor unit and 95°F DB /75°F WB for the outdoor unit and 25 feet of piping.

C. The operating range in cooling will be 23°F DB ~ 115°F DB.

2.2 INDOOR UNIT

A. General: The indoor unit shall be factory assembled and pre-wired with all necessary electronic and refrigerant controls. Both liquid and suction lines shall be individually insulated between the outdoor and indoor units. The unit shall have a self diagnostic function, 3-minute time delay mechanism, and have a factory pre-charge of R410A adequate for 25 feet of total length.

B. Unit Cabinet Ceiling Recessed Type:

1. The indoor unit shall have a finished cabinet for exposed ductless applications.

2. The drain and refrigerant piping shall be concealed above the finished ceiling for flexible installation from the right side.

3. The cabinet shall be supplied with suspension bracket for securely mounting the cabinet to threaded rod.

4. The cabinet includes a receiver to accept signals from a wired remote controller.

5. The indoor unit shall include a stub duct connection for air distribution to an adjoining zone as shown on the drawings.

6. The indoor unit shall include a factory mounted and wired high lift condensate drain pump capable of 29" lift. The condensate pan shall be internally trapped.

C. Unit Cabinet Ceiling Concealed Ducted Type:

1. The indoor unit shall have a galvanized steel, insulated cabinet for ceiling concealed ducted supply and return air applications. The unit shall contain factory fabricated filter housing suitable for a 1" or 2' MERV 6 replaceable filter element, complete with side access and coverplate with full gasket.
2. The drain and refrigerant piping shall be concealed above the finished ceiling for flexible installation from the right side.
3. The cabinet shall be supplied with suspension bracket for securely mounting the cabinet to threaded rod.
4. The cabinet includes a receiver to accept signals from a wired remote controller.
5. The indoor unit shall include a high lift condensate drain pump accessory, where applicable, capable of 29" lift. The condensate pump shall be internally trapped.

D. Fan:

1. The evaporator fan shall be an assembly with of a direct-driven single motor.
2. The fan shall be statically and dynamically balanced and operate on a motor with permanent lubricated bearings.
3. The indoor fan shall offer a choice of three speeds, High, Medium, and Low.
4. The supply air shall be distributed to the space through a 4-way blow wide blade grille.
5. The return air shall be returned to the unit through an integral center return air grille.

E. Filter:

1. The return air filter shall be integral to the unit and shall be replaceable or washable, based on unit configuration and manufacturers standard.

F. Coil:

1. The evaporator coil shall be a nonferrous, aluminum fin on copper tube heat exchanger.
2. All tube joints shall be brazed with silver alloy.
3. All coils shall be factory pressure tested.
4. A condensate pan shall be provided under the coil with a drain connection.
5. The evaporator coil shall be controlled by a factory mounted electronic thermal expansion valve.

G. Electrical:

1. The indoor unit shall be powered by 208 volt, 1 phase, 60 hertz power.

H. Control:

1. The indoor fan coil unit shall have a wired remote controller capable to operate the system.
2. The wired remote controller shall control: on/off operation, operation mode, fan speed, temperature set point and filter alarm.
3. The wired remote control shall perform fault diagnostic functions which may be system related, indoor unit or outdoor unit related depending on the fault code. Temperature range on the remote control shall be 64°F to 90°F in cooling mode and 50°F to 86°F in heating mode.
4. The indoor unit microprocessor shall have the capability to receive and process commands via return air temperature and indoor coil temperature sensors enabled by commands from the remote control.
5. The system shall have automatic restart capability after a power failure has occurred.

6. Multiple indoor fan coil units located in the same room shall be controlled in a master/slave configuration with a single wired remote controller connected to the master indoor unit and interconnecting wiring between the master and slave units.
7. Each system shall be networked to a centralized controller with data management service device to provide local schedule and set point control, error history management, and web server browsing from static IP address.

I. Sound:

1. Indoor unit sound levels shall not exceed: 41 dBA

J. MCU Refrigerant Distribution Control Module: (DN)

1. The MCU unit shall include refrigerant liquid, suction and hot gas connections to the outdoor unit. All three refrigerant lines shall be insulated from the MCU to the outdoor unit.
2. The MCU unit shall include refrigerant liquid and vapor connections to the indoor units.
3. The MCU unit shall include a 208/230-1-60 power supply connection.
4. The MCU shall include a condensate drain connection.
5. The MCU shall include a control communications connection for network to the indoor fan coil units and outdoor air-cooled condensing unit(s).
6. The MCU shall include heating and cooling solenoid valves for automatic distribution of liquid refrigerant or hot gas for simultaneous heating and cooling fan coil operation.

2.3 OUTDOOR UNIT

A. General: The outdoor unit(s) shall be specifically matched to the corresponding indoor unit size(s). The outdoor unit(s) shall be complete factory assembled and pre-wired with all necessary electronic and refrigerant controls.

B. Unit Cabinet: The cabinet shall be ivory with a finished powder coated baked enamel paint.

C. Fan

1. The fan shall be a direct drive, propeller type fan.
2. The motor shall be BLDC type with permanently lubricated type bearings and inherent overload protection.
3. The fan shall be capable of high static operation up to 0.31” WC for ducted applications.
4. A fan guard is provided on the outdoor unit to prevent contact with fan operation.
5. Airflow shall be vertical discharge.

D. Coil: The outdoor coil shall be nonferrous construction with corrugated fin tube.

E. Compressors:

1. The outdoor unit shall have a minimum two compressors. One compressor shall be a Copeland digital scroll compressor with 10% to 100% capacity modulation and one compressor shall be a Copeland fixed scroll compressor. Outdoor unit shall be capable of capacity modulation down to 10% of full load capacity.
2. The outdoor unit shall have an accumulator.
3. The compressor shall have an internal thermal overload.
4. The outdoor unit shall operate with a maximum vertical height difference of 164 feet and overall maximum piping length of 3280 feet and maximum 721 feet (equivalent length) from outdoor unit to furthest indoor unit.

F. Electrical:

1. The outdoor unit shall be powered by 208 volt, 3 phase, 60 hertz power.
2. The outdoor shall be controlled by a microprocessor located in the outdoor unit and via signals from the indoor units.

G. Sound: Outdoor unit sound levels shall not exceed: 64 dBA

2.4 DESIGN MAKE: Samsung

2.5. MANUFACTURERS: Daikin, Samsung, Mitsubishi (Citi-Multi), LG HVAC, Panasonic.

A. Any listed equivalent manufacturer and the Mechanical Contractor shall be completely responsible to comply with all requirements on the contract documents. This shall include, but not be limited to, space requirements, code clearances, the type, horsepower, capacities, number and size of services required from other trades.

B. Provide a letter from the VRF system manufacturer agent certifying completion of Pre-Construction installation training. Certification shall indicate that manufacturer's field piping and wiring recommendation for specified projects have been reviewed prior to installation.

PART 3 – EXECUTION

3.1 REFRIGERATION EQUIPMENT

A. All equipment shall be installed in accordance with manufacturer's recommendations.

3.2 FIELD QUALITY CONTROL

A. The system shall be installed under the supervision of a certified manufacturer's representative. Provide a letter from the VRF system manufacturer agent certifying completion of Pre-Construction installation training. Certification shall indicate that manufacturer's field piping and wiring recommendation for specified projects have been reviewed prior to installation.

B. Start up all units in accordance with manufacturer's start-up instructions. Replace damaged or malfunctioning controls and equipment.

C. Start up service and first year preventative/emergency service shall be provided by the manufacturer's authorized representative.

D. Customer operator training shall be provided by the manufacturer's authorized representative.

END OF SECTION

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SECTION 23 30 00
HVAC AIR DISTRIBUTION

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the contract, including the conditions of the contract (General, Supplementary and other Conditions, if any) and Division 1 as appropriate, apply to the work specified in this section.

B. Refer to Section 23 00 00 for HVAC General Provisions

C. Refer to Section 23 05 00 for HVAC Basic Materials & Methods.

D. This Contractor shall coordinate with the work of Division 26 and the Fire Alarm System vendor for locations and mounting of all duct smoke detectors. These devices are shown on the Mechanical Drawings for reference only to show the intent of the work. All locations shall be determined based on approved shop drawings from the Fire Alarm System vendor and the Contractor for the work of Division 26, Electrical. Mount smoke detectors in the supply and return air stream at each unit in accordance with NFPA 72.

1.2 DESCRIPTION OF WORK

A. This Section includes labor, material, equipment and supervision to provide a complete air distribution system as specified herein and as shown on drawings.

1. Ductwork – Single Wall, Square and Rectangular
2. Ductwork - Single Wall, Spiral Round
3. Ductwork - Spiral Round Aluminum (Pools)
4. Flexible Air Duct
5. Flexible Connections
6. Dampers
7. Fire Dampers
8. Air Diffusers, Registers and Grilles
9. Prefabricated Roof Curbs and Equipment Supports
10. Sound Attenuation
11. Duct Access Doors (Interior)
12. Fabric Air Dispersion Ductwork

1.3 REFERENCE STANDARDS

A. Refer to Section 23 00 00 for a general description of requirements applying to this section.

B. Requirements established within the portions of the Project Manual titled Division 1, General Requirements, are collectively applicable to the work of this section.

C. IMC (International Mechanical Code).

D. SMACNA (Sheet Metal and Air Conditioning Contractors National Association, Inc.)

E. American Society of Heating, Refrigerating and Air Conditioning Engineers' recommendations in ASHRAE Guide shall apply to this work.

F. ARI Standard 885 - Standard for Estimating Occupied Sound Levels in the Applications of Air Terminals and Air Outlets.

G. UL (Underwriter's Laboratories, Inc.)

H. NFPA 90A shall apply to this work.

I. State Fire Prevention Regulations.

1.4 QUALITY ASSURANCE

A. Refer to Section 23 05 00 for a general description of requirements applying to this Section.

1.5 SUBMITTALS

A. Submit shop drawings and product data in accordance with Section 23 00 00.

B. Submit the following:

1. Shop drawings of all sheet metal. Indicate all steel, piping, conduit, and Architectural/Structural features to demonstrate complete coordination. Scale shall not be less than ¼”.

   a. Shop drawings shall indicate the sizes and lengths of each section of ductwork as well as all system components such as coils, VAV boxes, access doors, dampers, diffusers and register locations. Also indicate the type of joints used and where internal acoustic lining or insulation, if required, will be utilized.

   b. The location of the duct runs and the air outlets shall be closely coordinated with all other trades by the sheet metal contractor to avoid interference. The shop drawings shall show the contact surfaces adjacent to the ducts or air outlets and the space assigned for concealment. The drawings shall indicate principal items of equipment, adjacent piping and conduit, etc., the location of which shall be secured from the contractors of other trades.

   c. Sheet Metal Contractor to include resubmissions of the shop drawings to the Engineer. The resubmissions are to include all corrections to previous submissions.

2. Manufacturer's literature and performance data of all equipment and devices.

3. Samples: Furnish color samples, etc., at request of the Architect.

1.6 SUBSTITUTIONS

A. The listed equivalent or substituted manufacturers along with the bidding related contractor shall be completely responsible to comply with all requirements on all contract documents. This shall include, but shall not be limited to space requirements, code clearances, the type, horsepower, capacities, number and size of services required from other trades, including all required ancillary items furnished and installed by other trades. If the manufacturer or related bidding contractor does not comply with these requirements, they shall be responsible for any and all additional costs associated with the changes required by other trades.

1.7 WARRANTY GUARANTEE

A. All work and materials are subject to the general warranty as described in the General Conditions of the Contract and in Division 1, General Requirements.

PART 2 – PRODUCTS

2.1 DUCTWORK (SINGLE WALL, SQUARE AND RECTANGULAR)

A. All ductwork shall be fabricated in accordance with SMACNA "HVAC Duct Construction Standards - Metal and Flexible" latest Edition except as described below. The minimum thickness of metal ductwork is 26 gauge. Fabrication requirements shall be based on ductwork subjected to positive or negative pressures of 4” W.G. Ductwork systems shall be sealed to SMACNA "Seal Class “A” Standards. Alternatively, "Ductmate" System 45 can be used in accordance with manufacturer's specifications. Drive slip joints are not permitted.

Exception: For ductwork smaller than 12” x 8”, Contractor may provide slip and drive joints with all joints sealed with Hardcast tape and mastic system.

B. Rectangular ducts for 4” W.G. or less, positive or negative pressure shall be per SMACNA Table 1-7. Longitudinal seams shall be Pittsburgh Lock Type L-l per SMACNA Figure 1-5. Transverse joints shall be standing seam type T -15 per Figure 1-4.

1. In the event that material size is not compatible with duct size and segmenting must be utilized to fabricate duct, use SMACNA Figure 1-5, seam L-4 (Standing Seam).

C. Joints:

1. Per SMACNA Transverse Joint Reinforcement Table 1-12, only joints T -22, T -25a, T -25b and Proprietary slip on flanges will be acceptable.
2. Joints T -25a and T -25b that have stress fractures from bending will not be accepted.
3. All joints will have butyl gasket 3/16" thick by 5/8" wide installed per manufacturers installation instructions.

D. Ductwork systems for this standard shall be galvanized sheet steel, commercial quality of lock - forming grade, conforming to ASTM coating standards A-525 or A-527 with coating of designation G-60. For corrosive or moist conditions, use coating designation G-90.

1. Where the outer surface of the duct is exposed in finished spaces and is not scheduled for insulation, duct material shall be galvannealed, suitable for field painting by the General Contractor.

E. The size and configuration of each duct shall be indicated on design drawings. Where thicker sheets or different types of materials are required, they shall be specified on the design drawings or in the project specifications.

F. Aluminum Rectangular Ductwork:

1. Aluminum ductwork shall be two B.& S. gauges heavier than specified for the equivalent width steel ductwork. Bracing, supports and joints shall be as specified for steel ductwork.
2. Aluminum ducts shall be used where the ducts are concealed when exhausting saturated air from dishwashing, showers, outside air intakes and similar designated spaces.
3. Dishwashing exhaust ducts shall be made watertight by means of silicone or 3M duct sealant properly installed and compressed at each joint and seam.

G. Kitchen exhaust duct shall have all joints, seams, penetrations and duct-to-hood collar connections with continuous, external, liquid-tight welds.

1. Carbon Steel: Fabricate from 16 gauge, ASTM-A569 hot rolled or ASTM-A366.
2. Stainless Steel: Fabricate from 18 gauge, Type 304, 2D finish.
3. Option: Factory fabricated grease duct system, U .L. listed, which meets all the requirements of NFPA 96.

2.2 DUCTWORK (SINGLE WALL, SPIRAL ROUND)

A. Design Pressure: 2”

B. Leakage: All ductwork shall meet SMACNA Class "A" leak standards.

C. Fabrication:

1. Gauges, reinforcing angles, seams, joints, fabrication methods, installation methods and practices, duct reinforcement, fabricated dampers and devices installed in duct system, fittings, etc., shall conform to the latest editions of SMACNA standards for construction in accordance with requirements indicated in these specifications.

2. Minimum metal gauges shall be 26 gauge (.019). Follow SMACNA Table 3-2A for Positive pressure and Table 3-2B for Negative pressure.
3. Where the outer surface of the duct is exposed in finished spaces and is not scheduled for insulation, duct material shall be galvannealed, suitable for field painting by the General Contractor.

D. Joints:

1. Duct up to 36" diameter - Male/Female beaded slip joint similar to SMACNA Figure 3-2, joint RT-1 or RT-5, as long as it meets the criteria for the system design pressure. Fittings shall be undersized to fit into spiral duct. All joints shall be secured with a minimum of 4 screws on each duct section (equally spaced). Seal joint with an approved sealant compound, continuously applied prior to assembly of joint and after fastening, making certain that the majority of the sealant resides on the interior of the joint.
2. Duct 37" - 60" diameter: Companion angle Vanstone with full face gaskets having bolt holes punched through prior to insertion of bolts. Gasketing shall be 1/8" thick. Joint is per SMACNA Figure 3-2, joint RT -2 and RT -2A.
3. For all dust collection and particulate carrying duct, SMACNA Figure 3-2, joint RT -3 up to 16" diameter and RT -2 or RT -2A are the only acceptable joints. RT -3 joints do not require any additional sealant as long as the band has gasketing installed by manufacturer. Joints RT -2 and RT -2A require full face gaskets having bolt holes punched through prior to insertion of bolts. Gasketing shall be 1/8" thick. There shall be no fasteners penetrating the duct for collection systems.
4. In lieu of beaded slip connections or Vanstone angle ring connections (the above-mentioned joints), there are proprietary connections that may be used, as long as they meet the pressure criteria set forth in this specification.

2.3 DUCTWORK – SPIRAL ROUND ALUMINUM (POOLS)

A. Submittals:

1. Submit manufacturer's technical product data for spiral round ductwork materials and products.
2. Shop Drawings detailing metal ductwork and fittings including, but not limited to, duct sizes, locations, elevations and slopes of horizontal runs, wall and floor penetrations, and connections. Show interface and spatial relationship between ductwork and approximate equipment. Show modifications of indicated requirements, made to conform to local shop practice, and how those modifications ensure that free area, materials, and rigidity are not reduced.

B. Quality Assurance:

1. Manufacturer's Qualifications Manufacturers are limited to members of Spiral Duct Manufacturers Association (SPIDA) who are dedicated to producing quality uniform products in accordance with Sheetmetal & Air Conditioning Contractors National Association (SMACNA) Standards.
2. Installer's Qualifications: Contractor with at least 3 years of successful installation experience on projects with metal ductwork systems similar to that required for project.

C. Ductwork Materials:

1. Exposed Ductwork Materials: Provide materials which are free from visual imperfections including pitting, dents and other imperfections, including those which would impair painting. Where painting is indicated on drawings, material shall be mill phosphatized (ASTM A591) sheetmetal suitable for immediate painting without further treating other than

normal cleaning.

2. Aluminum Ductwork: Where indicated, provide aluminum sheet complying with ASTM B209; Alloy 3003, Temper H14.

D. Miscellaneous Ductwork Materials:

1. Provide miscellaneous materials and products of types and sizes indicated and, where not otherwise indicated, provide type and size required to comply with ductwork system requirements including proper connection of ductwork and equipment.
2. Fittings: Provide radius type elbow fittings fabricated of multiple sections with maximum 22-½ deg. change of directions per section. Die stamped elbows are acceptable through 10 inch diameter. Unless specifically detailed otherwise, use 45° laterals and 45° elbows, 90° conical type fittings for branch connections.
3. Duct Sealant: Non-hardening, non-migrating mastic or liquid elastic sealant, type applicable for fabrication/installation detail, as compounded and recommended by manufacturer specifically for sealing joints and seams in ductwork.
4. Duct Cement: Non-hardening, non-migrating mastic or liquid neoprene based cement, type applicable for fabrication/installation detail, as compounded and recommended by manufacturer specifically for cementing fitting components or longitudinal seams in ductwork.
5. Ductwork Support Materials: Except as otherwise indicated, provide rust resistant, aluminum fasteners, anchors, rods, straps, trim and angles for support of ductwork. Space hangers to be 10 ft. on center.
6. Fittings shall be of wall thickness not less than that specified above for longitudinal seam straight ducts. See Field Quality Control for sealing requirements.

E. Fabrication:

1. Fabricate Round Ductwork in 10 or 12 feet lengths, unless otherwise indicated or required to complete runs as shown on approved shop drawings. Match-mark sections for assembly and coordinated installation.

Shop Fabricate Ductwork of gauges and reinforcement complying with SMACNA "HVAC Duct Construction Standards" as follows:

Maximum 2” w.g. Static Pressure			Maximum 2” w.g. Static Negative	
Duct Diameter In Inches	Spiral Seam Gauge	Longitudinal Seam Gauge	Spiral Seam Gauge	Longitudinal Seam Gauge
3 thru 8	.025”	.03”	.025”	.040”
9 thru 14	.025”	.03”	.032”	.040”
15 thru 26	.032”	.04”	.040”	.050”
27 thru 36	.040”	.05”	.050”	.063”
37 thru 50	.050”	.06”	.063”	.070”
51 thru 60	.063”	.07”	N.A.	.090”
61 thru 84	N.A.	.09”	N.A.	N.A.

F. Inspection:

1. Examine areas and conditions under which metal ductwork is to be installed. do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to installer.

2. SMACNA Standards comply with SMACNA's "HVAC Duct Construction Standards", Metal and Flexible" for fabrication and installation of metal ductwork.
3. Comply with NFP A 90A "Standard for the Installation of Air Conditioning and Ventilating Systems" and NFPA 90B "Standard for Installation of Warm Air Heating and Air Conditioning Systems".
4. Fabricate and install in accordance with SMACNA "HV AC Duct Construction Standards, Metal and Flexible".

G. Installation of Metal Ductwork:

1. Assemble and install ductwork in accordance with recognized industry practices which will achieve virtually air-tight and noiseless (no objectionable noise) systems, capable of performing each indicated service. Install each run with minimum number of joints. Align ductwork accurately at connections. Support ducts rigidly with suitable ties, braces, hangers and anchors of type which will hold ducts true-to-shape and to prevent buckling. Support vertical ducts at every floor.
2. Field Fabrication: Complete fabrication of work at project as necessary to match shop-fabricated work and accommodate installation requirements.
3. Routing:
   a. Locate ductwork runs, except as otherwise indicated, vertically and horizontally and avoid diagonal runs wherever possible. Locate runs by diagrams, details and notations or, if not otherwise indicated, run ductwork in shortest route which does not obstruct useable space or block access for servicing building and its equipment. Hold ducts close to walls, overhead construction, columns and other structural and permanent enclosure elements of building. Limit clearance to 1/2" where furring is shown for enclosure or concealment of ducts, but allow for insulation thickness, if any.
   b. Where possible, locate insulated ductwork for 1" clearance outside of insulation. Wherever possible in finished and occupied spaces, conceal ductwork from view, by locating in mechanical shafts, hollow wall construction or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as specifically shown. Coordinate layout with suspended ceiling and lighting layouts and similar finished work.
4. Penetrations:
   a. Where ducts pass through interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheetmetal flanges of same gauge as duct. Overlap opening on 4 sides by at least 1- 1/2". Fasten to duct and substrate.
   b. Where ducts pass through fire-rated floors, walls or partitions, provide firestopping between duct and substrate in accordance with requirements of Division 7 Section "Firestopping".
5. Coordination: Coordinate duct installations with installation of accessories, dampers, coil frames, equipment, controls and other associated work of ductwork system.
6. Installation: Install metal ductwork in accordance with SMACNA "HVAC Ductwork - Construction Standards."

H. Field Quality Control: Duct Sealing Requirements:

1. All ductwork shall be sealed in accordance with pressure classification listed herein:

Seal Class	Sealing Required	Static Pressure Construction Class
A	All transverse joints, longitudinal seams and duct wall penetrations.	4” w.g. and up
B	All transverse joints and longitudinal seams	3” w.g.
C.	Transverse joints	2” w.g. or less

2. Where sealing is required in Table above and otherwise herein, it shall mean the following:
   a. The use of adhesives, gaskets, tape systems or combinations thereof to close openings in the surface of the ductwork and field-erected plenums and casings through which air leakage would occur.
   b. The use of continuous welds.
   c. The prudent selection and application of sealing methods by fabricators and installers, giving due consideration to the designated pressure class, pressure mode (positive or negative), chemical compatibility of the closure system, potential movement of mating parts, workmanship, amount and type of handling; cleanliness of surfaces, product shelf life, curing time and manufacturer-identified exposure limitations.
   d. That these provisions are applicable to duct connections to equipment and to apparatus but are not for equipment and apparatus.
   e. That where distinctions between seams and joints are made herein, a seam is defined as joining of two longitudinally (in the direction of airflow) oriented edges of duct surface material occurring between two joints. Helical (spiral) lock seams are exempt from sealant requirements. All other duct surface connections made on the perimeter are deemed to be joints. Joints are inclusive of but not limited to girth joints; branch and sub-branch intersections; so-called duct collar tap-ins; fitting subsections; louver and air terminal connections to ducts; access door and access panel frames and jambs; duct, plenum and casing abutments to building structures.
   f. That sealing requirements herein do not contain provisions to:
      (1) Resist chemical attack.
      (2) Be dielectrically isolated.
      (3) Be waterproof, weatherproof or ultraviolet ray resistant.
      (4) Withstand temperatures higher than 120°F or lower than 40°F.
      (5) Contain atomic radiation or serve in other safety-related construction.
      (6) Be electrically grounded.
      (7) Maintain leakage integrity at pressures in excess of the duct classification herein.
      (8) Be underground below the water table.
      (9) Be submerged in liquid.
      (10) Withstand continuous vibration visible to the naked eye.
      (11) Be totally leak-free within an encapsulating vapor barrier.
      (12) Create closure in portions of the building structure used as ducts; e.g., ceiling plenums, shafts, pressurized compartments.

The exclusions in this section (t) shall mean "not defined or prescribed herein" and that the prescription of the design is required independently of this standard if obligatory.

g. The requirements to seal apply to both positive pressure and negative pressure modes of operation.

h. Externally insulated ducts located outside of buildings shall be sealed prior to being insulated as though they were inside. If metal surfaces of ducts located on the exterior of buildings are exposed to weather, they shall receive exterior duct sealant. An exterior duct sealant is defined as a sealant that is marketed specifically as forming a positive air and watertight seal, bonding well to the metal involved, remaining flexible with metal movement and having a service temperature range of -30oP to 175°P. If exposed to direct sunlight, it shall also be ultraviolet ray and ozone resistant or shall, after curing, be painted with a compatible coating that provides such resistance. The term sealant herein is not limited to materials of adhesive or mastic nature but is inclusive of tapes and combinations of open weave fabric strips and mastics.

I. Adjusting and Cleaning:

1. Temporary Closure: At ends of ducts which are not connected to equipment or air distribution devices at time of ductwork installation, provide temporary closure of polyethylene film or other covering which will prevent entrance of dust and debris until time connections are to be completed.

2.4 FLEXIBLE AIR DUCT

A. Insulated flexible air duct shall be non-metallic. Air duct shall comply with the latest NFPA Bulletin No. 90A and be labeled as Class 1 Air Duct, U.L. Standard No. 181.

B. Air ducts shall be suitable for working pressure of not less than plus 10.0 and minus 0.5 inches of W.G.

C. Non-metallic air duct shall be two element spiral construction composed of a corrosion resisting metal supporting spiral and a vinyl coated fiberglass base fabric and shall be mechanically interlocked together.

D. Insulation shall be 1-1/2” thick fiberglass flexible blanket with vapor barrier outer jacket of polyethylene or reinforced mylar. Maximum thermal conductance of 0.23 Btu/Hr./SF/Inch at 75 deg. F temperature.

E. Approved manufacturers shall include the Wiremold Company, Flexmaster USA, Owens-Corning, Thermaflex Flex Vent.

OR

A. Core material shall be an acoustical spun bond nylon fabric supported by helically wound galvanized steel. The fabric shall be mechanically fastened to the steel helix without the use of adhesive. The core shall maintain its free area and a center line radius of 1.0 or better.

B. The internal working pressure rating shall be at least as follows with a bursting pressure of at least 2½ times the working pressure.

1. Positive: 6 inches W. G.

2. Negative: 5 inches W. G.

C. The duct shall be rated for a velocity of at least 5,500 feet per minute.

D. Suitable for operating temperatures of at least 250°F.

E. Minimum Acoustic Performance:

1. The insertion loss (dB) of a 9 foot length of duct when tested in accordance with ASTM E 477 at a velocity of 2,500 feet per minute shall be at least:

	125 Hz	250 Hz	500 Hz	1,000 Hz	2,000 Hz	4,000 Hz
1) 8 inch dia.	27	27	32	33	37	33
2) 12 inch dia.	24	23	30	31	37	25

F. Insulation shall be fiberglass flexible blanket with metalized vapor barrier, rated for R6.

G. Manufacturer: Flexmaster USA

2.5 FLEXIBLE CONNECTIONS

A. Required between ductwork and suction and discharge connection of all fans and air handlers.

B. Material: Woven fiberglass with mounting hardware tested in accordance with UL Standard 181, listed and labeled as Class 0 or 1.

C. Manufacturer: Ventfabrics, Inc., Durodyne, Dynair, Ductmate Pro Flex.

2.6 DAMPERS

A. Provide where indicated and required to control flow of air and balance system.

B. Round dampers shall be single blade, molded synthetic bearings at each end, 20 gauge galvanized steel, adjusting quadrant and locking device. Round dampers shall be Ruskin Model MDRS25.

C. Rectangular and square dampers shall be opposed blade within 16 gauge galvanized steel channel frame with corner brace, 16 gauge galvanized steel blades; molded synthetic bearings and hex steel shafts, exposed or concealed linkage, adjustable quadrant and locking device. Dampers shall be Ruskin, Pottorff, Greenheck.

D. Approved Manufacturers: Ruskin, Pottorff, Greenheck.

2.7 FIRE DAMPERS

A. Fabricate in accordance with NFPA 90A and UL 555.

1. Ceiling Dampers: Galvanized steel, 22-gauge frame and 16-gauge flap, two layers 0.125-inch ceramic fiber on top side with locking clip.
2. Horizontal Dampers: Galvanized steel, 22-gauge frame, stainless steel closure spring, and lightweight, heat retardant, non-asbestos fabric blanket.
3. Curtain Type Dampers: Galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for closure under air flow conditions. Configure with blades out of air stream except for 1.0-inch pressure class ducts up to 12 inches in height.
4. Multiple Blade Dampers: 16-gauge galvanized steel frame and blades, oil-impregnated bronze or stainless steel sleeve bearings and plated steel axles, 1/8 x ½ inch plated steel concealed linkage, stainless steel closure spring, blade stops and lock.
5. Fusible Links: UL 33, separate at 160 deg. F with adjustable link straps for combination fire/balancing dampers.

B. Fire dampers of the applicable rating shall be provided at all locations where ductwork penetrates fire-rated walls, ceilings, or floors. Refer to Architectural Drawings.

C. Manufacturers: Air Balance, Inc., Ruskin, Louvers & Dampers, Prefco, Phillips-Aire, Metalaire, Pottorff, Lloyd Industries, Inc., Cesco Products, Greenheck, United Enertech.

2.8 AIR DIFFUSERS, REGISTERS AND GRILLES

A. Air diffusing terminals shall be provided in duct runs on drawings. The diffusers shall properly and uniformly distribute the design air quantity with no objectionable drafts, while maintaining not more than 50 F. P. M. velocity in the occupied portion of the space.

B. Ceiling Diffusers:

1. Perforated face air diffusers shall be nominal 24 X 24 size, with borders suitable for lay-in ceiling tile application. Diffusers shall provide one, two, three or four-way blow on the drawings. Provide diffusers with perforated face, 3/16" diameter holes on 1/4" staggered centers. Discharge pattern shall be easily adjusted by unlatching and dropping the perforated face, then rotating the pattern controllers. Diffusers shall be heavy gauge steel back pan and face. Finish shall be factory primed and painted with a baked-on white enamel finish.
   a. Manufacturer: Price Model PDMC

OR

1. Perforated face radial air diffusers shall be nominal 24x24 or 24x48 module size with borders suitable for lay-in ceiling tile application. Diffusers shall provide two-way blow. Provide diffusers with 51 % free area perforated face, 3/16" diameter holes on 1/4" staggered centers. Diffusers shall be heavy gauge steel back pan, maximum 6" deep and face maximum 5/8" deep reveal on face plate. Finish shall be factory primed and painted white.
   a. Face and air chamber shall be provided with two retainer cables.
   b. Manufacturer: Price HCF
2. Square Louvered Diffuser Face:
   a. Square housing, welded steel construction core of square concentric louvers, removable at face of diffuser, round duct connection, with borders suitable for lay-in ceiling tile application.
   b. Diffuser Patterns: Fixed louver face for 1, 2, 3, or 4 direction air flow, direction indicated on drawings.
   c. Finish: Matte white finish.
   d. Manufacturers: Price Model SMD
3. Square Ceiling Supply Diffuser:
   a. Square panel ceiling diffusers shall have a 22-gauge steel face panel that captures a secondary 22-gauge panel. The Price ASPD shall have a heavy gauge aluminum face panel that captures a secondary heavy gauge aluminum panel. The exposed surface of the face panel shall be smooth, flat, and free of visible fasteners. The back of the face panel shall have an aerodynamically shaped, rolled edge to ensure a tight horizontal discharge pattern.
   b. The back pan shall be one piece precision die-stamped and shall include an integrally drawn inlet. The diffuser back pan shall be constructed of 22-gauge steel. The finish shall be #26 white. The finish shall be a baked on anodic acrylic paint, with a pencil hardness of HB to H.
   c. Back shall have molded insulation blanket. The insulation shall be R-6, foil-backed, and provide an additional 1-inch gap around the neck to install insulated flex duct.
   d. Price Model SPD
4. Round Ceiling Supply Diffuser:
   a. Round plaque ceiling diffusers shall be constructed of 18-gauge steel and heavy gauge aluminum plaque face. The exposed surface of the plaque shall be smooth and flat. The airflow discharge pattern shall be field adjusted from horizontal to vertical by repositioning the plaque assembly using the adjusting screws. The plaque assembly shall be constructed as a single inner assembly and must be easily removable.

b. The finish shall be #26 white. The finish shall be a baked on anodic acrylic paint, with a pencil hardness of HB to H.

c. Price Model RPD

5. Round Cone Diffusers:

a. Adjustable round cone diffuser, welded steel construction with round neck and removable inner assembly of cones.

b. Air pattern shall be field adjustable from horizontal to vertical.

c. Finish: Matte white finish

d. Price Model RCD

C. Registers & Grilles:

1. Registers and grilles shall be steel construction, fixed single deflection type, with clips and/or flange holes and screws (as required by Architectural finishes) to secure registers to ceiling construction. Face bars shall be inclined 30 degrees. Registers and grilles shall be factory primed and painted with a baked-on white enamel finish.

2. Wall Supply Registers:

a. Provide manufacturer's standard wall registers where shown; of size, shape, capacity, type of materials and components indicated.

b. Register Materials: Steel construction: Manufacturer's standard stamped sheet steel frame and adjustable blades.

c. Register Faces: Horizontal Straight Blades: Horizontal blades, individually adjustable, at manufacturer’s standard spacing.

d. Register Patterns: Double Deflection: 2 sets of blades in face, rear set at 90 degrees to face set.

e. Register Finishes: Aluminum Enamel: Air-dried aluminum enamel prime finish.

3. Direct Spiral Duct-Mounted Supply Grilles:

a. Aluminum supply grilles shall be direct spiral duct-mounted supply grilles, double deflection of the sizes and mounting types as shown on the plans. The deflection blades shall be available parallel to the long or short dimension of the grille or register. All supply grilles shall be constructed with radius end caps and foam gaskets for a tight seal to the duct diameter. All supply grilles shall be constructed with a border.

b. Blades shall be constructed of heavy duty extruded aluminum and shall be spaced ¾” apart. Blades shall extend completely through the side frame on each side to ensure stability. Blades shall be individually adjustable without loosening or rattling and shall be securely held in place with tension wire.

c. Air scoop damper/extractor shall be constructed of heavy duty aluminum. The ASD must be operable from the face with a screwdriver.

d. The grille finish shall be as selected by the Architect.

4. Supply Grilles (SG):

a. Aluminum supply grilles shall be available parallel to the long dimension of the grille. All supply grilles shall be constructed with a 11/4-inch wide heavy aluminum border having a minimum thickness of 0.040-0.050 inch. Outer borders shall be assembled and interlocked at the four corners and mechanically staked to form a rigid frame. Screw holes shall be countersunk for a neat appearance.

b. Blades shall be constructed of heavy duty aluminum and shall be contoured to a

specifically designed airfoil cross-section to meet published performance data. Where indicated in drawing schedule or plans opposed-blade volume damper shall be constructed of heavy gauge steel or aluminum.

c. The finish shall be #26 white. The finish shall be a baked on anodic acrylic paint, with a pencil hardness of HB to H.

d. Price Model 22

5. Ceiling Return Register (CR):

a. Ceiling registers shall have a perforated face with 3/16-inch diameter holes on 1/4-inch staggered centers and no less than 51 percent free area. Perforated face shall be aluminum according to the model selected. The back pan shall be one piece stamped heavy gauge steel of the sizes and mounting types shown on the plans and outlet schedule.

b. The finish shall be #26 white. The finish shall be a baked on anodic acrylic paint, with a pencil hardness of HB to H. Inside of back pan shall be painted flat black.

c. Price Model PDDR

6. Return Grille (RG):

a. Return grilles shall provide a free area of at least 90%. Outer borders shall be constructed of heavy extruded aluminum with a thickness of 0.040-0.050 inch and shall have countersunk screw holes for a neat appearance. Aluminum grid shall be 1/2 x 1/2 x 1/2 inch.

b. The finish shall be #26 white. The finish shall be a baked on anodic acrylic paint, with a pencil hardness of HB to H.

c. Price Model 80

7. Supply, Return, Exhaust and Transfer Grilles (SG, RG, EG & TG):

a. Grilles shall be available parallel to the long dimension of the grille. Construction shall be of steel with a 11/4-inch wide border on all sides. Screw holes shall be countersunk for a neat appearance. Corners shall be welded with full penetration resistance welds.

b. Deflection blades shall be firmly held in place by mullions from behind the grille and fixed to the grille by welding in place. Blade deflection angle shall be available at 35°.

c. The finish shall be #26 white. The finish shall be a baked on anodic acrylic paint, with a pencil hardness of HB to H.

d. Price Model 520FL(SG), 535 FL(RG,EG & TG)

8. Ceiling Return Filter Grille (CR):

a. Return filter grilles shall be of size and mounting type as shown on the drawings and schedules.

b. Return grilles shall provide minimum free area of 90%.

c. Borders shall be constructed of heavy extruded aluminum with countersink holes or frame suitable for ceiling finish in each room.

d. The four corners shall be interlocked and mechanically staked to form a rigid frame.

e. Aluminum grid core shall have ½ x ½ x ½ inch openings

f. Return grilles shall be provided with a filter frame that will accommodate a standard 1-inch thick disposable filter to fit the specified duct size. Filter shall be grille module size minus 4 inches. Filter capacity shall be as scheduled on the drawings.

g. Return grille finish shall be white powder coat.

h. Price Model 535FF

9. Ceiling Louvered Return Filter Grille (CR):

a. Return filter grilles shall be of size and mounting type as shown on the drawings and schedules.

b. Borders shall be constructed of steel with countersink holes or frame suitable for ceiling finish in each room.

c. The four corners shall be interlocked and mechanically staked to form a rigid frame.

d. Deflection blades shall be ½ inch spacing, 45° deflection.

e. Return grilles shall be provided with a filter frame that will accommodate a standard 1-inch thick disposable filter to fit the specified duct size. Filter shall be grille module size minus 4 inches. Filter capacity shall be as scheduled on the drawings.

f. Return grille finish shall be white powder coat.

g. Price Model 535FF

D. Manufacturers: Provide diffusers, registers and grilles of one of the following:

Anemostat	Price
Carnes Co.	Titus
Krueger	Tuttle & Bailey
Metalaire	Nailor Industries

2.9 PREFABRICATED ROOF CURBS AND EQUIPMENT SUPPORTS

A. Factory fabricated by the manufacturer of the respective roof-mounted equipment when available and capable of meeting the following requirements:

1. Thermally and acoustically insulated, rubber isolating pads.

2. Built to suit slope of roof and type of roofing; i.e. standing metal seam with integral cant strip and flashing extension.

3. 8” to 11” height unless otherwise indicated.

4. Support rails shall be aluminum, or sheet steel, with continuous wood nailer and removable counterflashing.

B. Curbs shall be a product of a custom manufacture in the following cases:

1. Curbs as specified are not available from the respective equipment manufacturer.

2. Piping or ducts penetrating roof.

3. Prefabricated equipment supports are required.

4. Step flashing assembly, EPDM for normal use and silicone for pipe temperatures above 200°F stainless steel clamp, suitable for single or multiple pipes.

C. Pipe supports shall be a product of a custom manufacture equal to Pipe Prop as made by JMB Industries, or Anvil International Haydon H-Block.

D. Manufacturers: Pate, Shipman, Custom Curb, Portals Plus, Lloyd Industries, Inc., PHP Systems/Design.

2.10 SOUND ATTENUATION

A. Provide silencers of the types and sizes shown on plans.

B. Materials and Construction:

1. Outer casings of rectangular silencers shall be made of 22-gauge galvanized steel in accordance with ASHRAE Guide recommended construction for high pressure rectangular duct work. Seams shall be lock formed and mastic filled.
2. Outer casings of tubular silencers shall be made of galvanized steel.
3. Interior partitions for rectangular silencers shall be made of not less than 26 gauge galvanized perforated steel.
4. Interior construction of tubular silencers shall be compatible with the outside casings.
5. Filler material shall be of inorganic mineral or glass fiber of a density sufficient to obtain the specified acoustic performance and be packed under not less than 5 % compression to eliminate voids due to vibration and settling. Material shall be inert, vermin and moisture-proof.
6. Combustion rating for the silencer acoustic fill shall be not less than the following when tested in accordance with ASTM-E-84, NFPA Standard 255 or UL No. 723:

Flamespread Classification	25
Smoke Development Rating	15
Fuel Contribution	20

7. Airtight construction shall be provided by use of a duct sealing compound on the job site. Material and labor furnished by contractor. Silencers shall not fail structurally when subjected to a differential air pressure of 8 in. w.g. inside to outside of casing.

C. Acoustic Performance: Silencer ratings shall be determined in a duct- to-reverberant room test facility which provides for airflow in both directions through the test silencer in accordance with ASTM Specification E-477. The test set-up and procedure shall be such that all effects due to end reflection, directivity, flanking transmission, standing waves and test chamber sound absorption are eliminated. Acoustic ratings shall include Dynamic Insertion Loss (DIL) and Self- Noise (SN) Power Levels both for Forward Flow (air and noise in same direction) and Reverse Flow (air and noise in opposite directions) with airflow of at least 2000 fpm entering face velocity.

D. Aerodynamic Performance: Silencer shall be of the low static pressure loss type. Airflow measurements shall be made in accordance with ASTM specification E-477 and applicable portions of ASME, AMCA and ADC airflow test codes. Tests shall be reported on the identical units for which acoustic data is presented.

E. Certification: With submittals, the manufacturer shall supply certified test data on Dynamic Insertion Loss, Self-Noise Power Levels, and Aerodynamic Performance for Reverse and Forward Flow test conditions. Test data shall be for a standard product. All rating tests shall be conducted in the same facility, shall utilize the same silencer, and shall be open to inspection upon request from the Architect/Engineer.

F. Manufacturers: Industrial Acoustics Co., Rink, Commercial Acoustics, Dynasonics, BRD, Vibro-Acoustics.

2.11 DUCT ACCESS DOORS (Interior Locations)

A. SMACNA standard duct access doors shall be fabricated with 22-gauge galvanized steel door and frame with double wall construction.

1. Doors shall be fabricated of aluminum when installed in aluminum ductwork and stainless steel to match special duct systems.

B. Continuous piano type hinge, same material as door.

C. Latches shall be sash type locks equal to Ventlock 100 latches.

1. Doors 16" and under shall have one latch.

2. Doors over 16" shall have two latches.

D. Door seals shall be foam gasket material continuously bonded to perimeter of door frame.

E. Door insulation shall be 1" thick fiberglass, minimum 1.5 pcf density.

F. Doors shall be able to withstand 3" W.C. static pressure up to 12" x 12" in size; 2" W.C. above that size.

G. Makes: Cesco Products, Karp Co., Nailor-Hart Industries, Pottorff, Lloyd Industries, Inc., Ductmate Industries, Inc.

2.12 FABRIC AIR DISPERSION DUCTWORK

A. Product shall be constructed of a coated woven fire retardant fabric complying with the following physical characteristics:

1. Type: S-Sedona, V-Verona, D-DuraTex, T-TufTex
2. Configuration:
   a. Standard: round
   b. Surface: D-shape or Quarter round.
3. Fabric Construction:
   a. Fiberglass reinforced polyester twill. (S)
   b. Plain polyester weave. (D) (T) (V)
4. Coating:
   a. Porous. (S) (V)
   b. Non-porous. (D) (T)
   c. Antimicrobial agent, 99% effective after 10 laundry cycles, per AATCC Test Method 100 (S)
5. Weight:
   a. 5.2 oz. per square yard. (V)
   b. 5.5 oz. per square yard. (D)
   c. 6.7 oz. per square yard. (S)
   d. 8.2 oz. per square yard. (T)
6. Permeability:
   a. None (D) (T)
   b. 2 cfm per square foot @ 0.5” WC. (S) (V)
7. Color:
   a. Standard color as selected by the Architect
   b. Custom color as selected by the Architect
8. Warranty:
   a. 5 years on products for the fabric system. (D) (V)
   b. 10 years on products for the fabric system. (S) (T).
9. Temperature Range: 0 degrees F to 180 degrees F
10. Fire Retardancy: Classified by Underwriters Laboratories in accordance with the 25/50 flame spread/smoke developed requirements of NFPA 90-A.

B. Systems Fabrication Requirements:

1. Air dispersion accomplished by round vent, and consist of open orifices rather than a mesh style vent to reduce maintenance requirements (common to mesh style).
2. Size of and location of vents shall be specified and approved by manufacturer.
3. Inlet connection to metal duct via fabric draw band with anchor patches supplied by manufacturer. Anchor patches shall be secured to metal duct via. zip screw fastener - supplied by contractor.
4. Inlet connection includes zipper for easy removal / maintenance.
5. Lengths to include required zippers as specified by manufacturer.

6. System to include Adjustable Flow Devices to balance turbulence, airflow and distribution as needed. Flow restriction device shall include ability to adjust the airflow resistance from 0.06 - 0.60 in w.g. static pressure.
7. End cap includes zipper for easy maintenance.
8. Fabric system shall include connectors to accommodate suspension system listed below.
9. Any deviation from a straight run shall be made using a gored elbow or an efficiency tee. Normal 90 degree elbows are 5 gores and the radius of the elbow is 1.5 times the diameter of the DuctSox.

C. Design Parameters:

1. Fabric air diffusers shall be designed from 0.25" water gage minimum to 3.1" maximum, with 0.5" as the standard.
2. Fabric air diffusers shall be limited to design temperatures between 0 degrees F and 180 degrees F.
3. Design CFM, static pressure and diffuser length shall be designed and approved by the manufacturer.
4. Do not use fabric diffusers in concealed locations.
5. Use fabric diffusers only for positive pressure air distribution components of the mechanical ventilation system.

D. Suspension Hardware:

1. Internal Hoop System: Provide a factory fabricated retention system consisting of an internal 360° hoop system spaced on maximum 5’ centers. Each hoop shall be fabricated of lightweight aluminum ring and tubing with negligible effect on airflow static resistance. The rings located at the inlet and end of run shall include tensioning anchor clips to secure the fabric to the hoop system. Sizes shall include 8” to 36” diameter in 2” increments. The system shall be installed with a one row suspension system located 1.5” above top dead center of the fabric duct system. System attachment shall be either cables or u-track using gliders spaced 12” on center.

E. Manufacturer: Duct Sox by Fabric Air Dispersion Products, Q Sox by Fabric Duct Systems, Inc., Air Sox by Euro Air, Hero Fabri Duct by Hero Fabri Duct, Inc., Fabric Air Inc., or KE Fibertec.

PART 3 – EXECUTION

3.1 DUCTWORK

A. Ducts shall be concealed unless otherwise indicated.

B. Changes in direction shall be made with radius bends or turning vanes.

C. Supports shall be galvanized steel for steel ductwork and aluminum for aluminum ductwork.

D. Locate ceiling air diffusers, registers, and grilles on "Reflected Ceiling Plans". Unless otherwise indicated, locate units in center of acoustical ceiling modules.

E. Do not install ductwork directly above any electrical equipment.

F. Ductwork shall be supported per SMACNA Standards except as follows:

1. Rivet or screw to side of duct when using flat strap hangers. Rivet or screw to bottom of duct when using trapeze hangers.
2. Extend hangers down the side of the duct at least 9"; pass hangers under ducts less than 9" deep.

3. Space hangers not more than 8' on centers for ducts up to 18" wide and 4' on centers for ducts over 18" wide.
4. Wire hangers are not acceptable.
5. Support ductwork from building structure with expansion bolts, rods, steel angles or channels installed to meet existing or new building conditions.
6. Drilling into the roof deck is not permitted.
7. Driving nails into anchors is not permitted.

G. Air Flow Control:

1. Major take-offs: Install volume control dampers.
2. Branches: Install volume control dampers in all branches and at tap in branch take-off connections.
3. Elbows: Use unvaned elbows with throat radius equal to width of duct and full heel radius; provide turning vanes where full throat and heel radius are not possible.
4. Transitions: Make transitions in ducts as required by structural or architectural interferences.
   a. Proportion airways to compensate for any obstructions within duct.
   b. Avoid dead ends and abrupt angles.
   c. Do not exceed 15 degrees slope on sides of transitions.

H. For all exterior single wall, square or rectangular ductwork, ensure that the top of all horizontal ductwork is crowned to minimize accumulation of weather on top of the finished insulation system jacket specified in Section 230230.

I. Ductwork on the roof shall be supported by an engineered, prefabricated hanger system specifically designed for installation on the roof without roof penetrations, flashing or damage to the roofing material. The system shall consist of bases made of high density polypropylene plastic with additives for UV protection, hot dipped galvanized structural steel frames, hangers, fasteners, rods, etc. The system shall be completed and designed to fit the ductwork installed under actual conditions of service. The system shall be furnished as manufactured by PHP Systems & Design or Anvil International Haydon H-Block. (Designer Choice)

3.2 LOUVERS

A. When open louvers are provided on a job, and the louver is open on the back, the contractor shall provide a 2" deep drip pan. Pan shall extend the full length of the louver. Drip pan shall be fabricated from a minimum of 24-gauge galvanized sheet steel. Cross break pan for rigidity. All seams to be welded.

B. Drip pans shall be securely fastened to building structure. Do not hang pans from ductwork, piping systems or equipment. Contractor shall submit shop drawings, showing pan detail and methods of support.

OR

3.2 LOUVERS

A. Locate and place louver units level, plumb and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible.

C. Provide perimeter reveals and openings of uniform width for sealants and joint fillers.

D. Repair damaged finishes so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alternations and refinish entire unit or provide new units.

E. Protect galvanized and non-ferrous metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry or dissimilar metals.

3.3 FLEXIBLE AIR DUCT

A. When flexible duct is used for final connection between duct mains on branches and diffusers on registers. The maximum length of flexible ductwork shall be 5'-0" in length.

B. Flexible ductwork shall be properly hung at the tap collar in order to prevent eventual wear and damage to the flexible duct.

C. The ceiling tile system should not be considered a support on which to lay flexible duct. Refer to SMACNA Standards for proper installation.

3.4 DUCT SYSTEM LEAK SEALING

A. Joints in duct systems at duct heaters, air monitors, fire dampers, sound traps, supply air terminals including air handling light fixtures, shall be sealed to prevent air leakage.

B. All duct joints and seams in medium pressure and high pressure duct systems shall be sealed to SMACNA Seal Class" A" Standards to prevent air leakage.

C. In the event there is in excess of 5% air leakage indicated in low pressure duct systems, it shall be the Contractors responsibility to seal the duct system. The amount of sealing necessary shall be that required to obtain the design air quantity at each terminal.

D. Duct sealing shall be by means of high velocity duct sealants such as Hardcast and/or Neoprene gaskets. Type of sealant and method of application shall conform to recommendations in SMACNA high velocity duct construction standards.

3.5 DUCTWORK TESTING

A. The following ductwork shall be pressure leak tested:

1. Supply ductwork
2. Return ductwork
3. Exhaust ductwork
4. Outside air intake ductwork

B. All tests shall be conducted in accordance with AABC National Standards.

C. Ducts to be tested at 100% maximum of static pressure before any duct is insulated externally and concealed in accordance with SMACNA Standards.

D. Calculate the allowable leakage using leakage factor of 5% of Design Air Flow.

E. Select a limited section of duct for which the estimated leakage will not exceed capacity of the test apparatus.

F. Connect the blower and flow meter to the duct section and provide temporary seals at all openings of the ductwork.

G. Start the blower motor with the inlet damper closed. Increase pressure until the required level is reached.

H. Read the flow meter and compare the leakage in cfm. Reading should be 5% or less of design flow for the duct segment being tested.

I. If reading is more than 5% of design flow, depressurize duct, repair all leaks and retest until 5% or less of design flow is obtained.

J. Complete test reports and obtain Owner's witness signature.

K. Remove all temporary blanks and seals.

L. Warning: Do not overpressure duct.

3.6 EQUIPMENT

A. Test apparatus shall consist of an airflow measuring device, flow producing unit, pressure indicating devices and accessories necessary to connect the metering system to the test specimen.

B. The Contractor conducting tests shall arrange for or provide all temporary services, all test apparatus, all temporary seals and all qualified personnel necessary to conduct the specified testing.

C. Test apparatus shall be accurate within plus or minus 7.5% at the indicated flow rate and test pressure and shall have calibration data or a certificate signifying manufacture of the meter in conformance with the ASME Requirements for Fluid Meters. Verification of above, to be supplied to Owner upon request.

D. Pressure differential sensing instruments shall be readable to 0.05" scale division for flow rates below 10 cfm or below 0.5" w.g. differential. For flows greater than 10 cfm scale divisions of 0.1" are appropriate. U-tube manometers should not be used for reading less than 1" of water.

E. Liquid for manometers shall have a specific gravity of 1 (as water) unless the scale is calibrated to read in inches of water contingent on use of a liquid of another specific gravity, in which case the associated gauge fluid must be used.

F. Instruments must be adjusted to zero reading before pressure is applied.

3.7 TEST REPORT

A. Log the project and system identification data.

B. Enter the fan CFM, the test pressure, and the leakage class specified by the designer.

C. Enter an identification for each duct segment to be tested.

D. Calculate the allowable leakage factor. Enter this number on the report for each test segment.

E. Conduct and record the field tests. If the sum of the CFM measured is less than or equal to the sum of the allowable leakage, the test is passed. Record the date(s), presence of witnesses and flow meter characteristics.

F. Maintain a mechanical duct plan of all tested duct segments. Plan to include duct segment identification and dates tested.

G. Test reports shall be submitted as required by the project documents.

3.8 LABELING

A. At all fire damper, smoke damper and combination fire/smoke damper locations, access doors in ductwork shall be identified with a permanent placard of red-white-red laminated commercial grade plastic construction, minimum one-half inch high capital letters, reading, “FIRE DAMPER”, “SMOKE DAMPER”, “FIRE/SMOKE DAMPER” as appropriate for the installation. Attach securely to face of access door with brass screws at each corner, sealed airtight.

3.9 DOUBLE-WALL PHENOLIC DUCT SYSTEM

A. Air Leakage: Ductwork system air leakage shall be in accordance with the requirements of the relevant jurisdiction. (Consult the DOE (US Department of Energy) ComCheck/ResCheck or the relevant authority for applicable codes/standards).

B. Support:

1. It shall be the responsibility of the installer to ensure that the ductwork system is properly and adequately supported. A number of support systems are approved for use by AQC Industries. It shall be the responsibility of the installer to ensure that the chosen method of support is

compatible with ductwork fabricated from the Pal Phenolic Duct System and AQC Industries.

2. Supports on straight runs of the Q Duct Ductwork System shall be positioned at center's not exceeding 10 ft. for ductwork sections fabricated in 10 ft. lengths, and 13 ft. for ductwork sections fabricated in 13 ft. lengths.
3. Additionally, ductwork shall be supported at changes of direction, at branch duct connections, tee fittings, etc.
4. All ductwork accessories such as dampers shall be independently supported.

C. Hangers and Supports:

1. Hanger Materials: SMACNA approved duct supports shall be utilized in accordance with SMACNA Standards for Phenolic Duct.
2. Penetration into the Q Duct System duct is not permitted.
3. Trapeze and Riser Supports: Steel shapes complying with ASTM A 36/A 36M.
4. Exterior Duct Supports:
   a. To meet all SMACNA and ASHRAE requirements.
   b. Supports to be installed on the outside finished Q Duct System.
   c. Supports to be manufactured by PHP System/Design, Miro or approved equal.

D. Storage and Handling:

1. Care shall be exercised in the handling and transportation of Q Duct ductwork sections in order to prevent physical damage.
2. All Q Duct ductwork sections shall be stored under cover, clear of the ground or roof and protected from the weather and sunlight by an opaque and light colored waterproof material. In cases where the ductwork sections are to be stored for prolonged periods, the open ends of the ductwork sections shall be sealed with a polythene sheet or other suitable material to prevent the ingress of foreign matter.

END OF SECTION

SECTION 23 34 00
HVAC FANS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the contract, including the conditions of the contract (General, Supplementary and other Conditions, if any) and Division 1 as appropriate, apply to the work specified in this section.

B. Refer to Section 23 00 00 for HVAC General Provisions

C. Refer to Section 23 05 00 for HVAC Basic Materials & Methods.

1.2 DESCRIPTION OF WORK

A. This Section includes labor, material, equipment and supervision to provide a complete air distribution system as specified herein and as shown on drawings.

1. Fans (Utility Set Type)
2. Recessed Ceiling Fan
3. Roof-Mounted Exhaust Fans
4. Vertical Discharge exhaust Fan (Kitchen, Dishwashing, Laboratories, Fume Hoods)

1.3 REFERENCE STANDARDS

A. Refer to Section 23 00 00 for a general description of requirements applying to this section.

B. Requirements established within the portions of the Project Manual titled Division 1, General Requirements, are collectively applicable to the work of this section.

C. IMC (International Mechanical Code)

D. SMACNA (Sheet Metal and Air Conditioning Contractors National Association, Inc.)

E. American Society of Heating, Refrigerating and Air Conditioning Engineers' recommendations in ASHRAE Guide shall apply to this work.

F. UL (Underwriter's Laboratories, Inc.)

G. NFPA 90A shall apply to this work.

H. State Fire Prevention Regulations.

1.4 QUALITY ASSURANCE

A. Refer to Section 23 05 00 for a general description of requirements applying to this Section.

B. Whenever a variable frequency PWM drive is installed to control an AC motor, a maintenance-free, circumferential, conductive micro fiber shaft grounding ring shall be installed on the AC motor drive end to discharge shaft currents to ground. Recommended part: AEGIS SGR™ Bearing Protection Ring, as made by Electro Static Technology. Install in accordance with the manufacturer’s written instructions.

1.5 SUBMITTALS

A. Submit shop drawings and product data in accordance with Section 230200.

B. Submit the following:

1. Shop drawings of all sheet metal. Indicate all steel, piping, conduit, and Architectural/Structural features to demonstrate complete coordination. Scale shall not be less than 1/4" = 1'-0".
2. Manufacturer's literature and performance data of all equipment and devices.

1.6 SUBSTITUTIONS

A. The listed equivalent or substituted manufacturers along with the bidding related contractor shall be completely responsible to comply with all requirements on all contract documents and as described within the specifications. This shall include, but shall not be limited to space requirements, code clearances, the type, horsepower, capacities, number and size of services required from other trades, including all required ancillary items furnished and installed by other trades. If the manufacturer or related bidding contractor does not comply with these requirements, they shall be responsible for any and all additional costs associated with the changes required by other trades.

1.7 WARRANTY/GUARANTEE

A. All work and materials are subject to the general warranty as described in the General Conditions of the Contract and in Division 1, General Requirements.

PART 2 – PRODUCTS

2.1 FANS (UTILITY SET TYPE)

A. Utility set type fans shall be completely assembled units consisting of a continuously welded steel scroll housing, centrifugal fan wheel, structural steel base and motor combination with inlet and outlet flanges prepunched.

B. Fan wheel shall be multi-blade type with hub and backplate and inlet ring. Entire fan wheel assembly shall be steel or aluminum. Fan blades shall be forward or backward inclined type. Provide spark-proof fan.(Designer Choice) Wheel shall be statically and dynamically factory balanced.

C. Scroll housing shall be steel with adjustable discharge feature. Inlet cone shall be spun steel with streamline venturi characteristic. Access door shall provide inspection of wheel and fan interior, fully hinged with multiple closures.

D. Fan motor shall have copper windings and be grease packed ball bearing type of open drip-proof construction. Where called for on drawings or indicated in schedule.

E. Fan wheel shall be indirectly driven through a V-belt drive, and the drive shall be designed for 150% of the driven load and the motor pulley shall be adjustable pitch type. Where called for on drawings or indicated in schedule. Fan shaft shall be ASTM A-108 steel, grade 1018 or 1045.

F. Fans on roof shall be provided with a hinged weather hood over motor and drive, and a drain connection in bottom of scroll housing. The weather hood shall also protect a disconnect switch which shall be factory mounted by the fan manufacturer. Hood shall be vented to reduce heat build-up.

G. Fans shall bear the AMCA seal and shall be manufactured by Acme, Aerovent, American Coolair/ILG, Buffalo Forge, Hartzell, Loren-Cook, Temtrol, Twin City Fan.

2.2 RECESSED CEILING FAN

A. Recessed ceiling fan shall consist of a rectangular steel cabinet enclosing a true centrifugal fan directly driven by an electric motor.

B. Cabinet shall be complete with a finished plastic ceiling grille and discharge collar equipped with a backdraft damper, metal or plastic, gravity or spring return.

C. Motor and fan shall be conveniently removable with plug-in power chord.

D. The casing shall be sound attenuated, with minimum ½” thick acoustic lining.

E. Unit shall be AMCA certified.

F. Manufacturers: Loren-Cook, Penn Ventilator, Acme, Carnes, Greenheck, Breidert, Panasonic.

G. Manufacturers: Broan, Carnes, Nutone, Panasonic

2.3 ROOF-MOUNTED EXHAUST FANS

A. Aluminum casing shall be heavy gauge, mill finish of spun construction, weatherproof, removable, with aluminum birdscreen.

B. Aluminum centrifugal fan, adjustable V-belt drive selected for 150% of motor ampere rating.

C. Fans shall be quiet operating, selected for sound level below that of the space ventilated.

D. Accessories: Disconnect switch, insulated roof curb and motor-operated damper or backdraft damper.

E. Manufacturers: Penn Ventilator Co., Greenheck, Loren Cook, Acme, Carnes, Breidert, Hartzell.

2.4 VERTICAL DISCHARGE EXHAUST FAN (KITCHEN, DISHWASHING, LABORATORIES FUME HOODS)

A. The exhaust fan shall be a vertical discharge, roof-mounted, power ventilator with heat, vapor and fume resistant features.

B. The casing shall consist of base curb cap, ventilated motor compartment, and upper and lower exterior wind bands. The casing shall be of mill finish aluminum of spun construction.

C. Fan wheel shall be centrifugal backward curved type constructed of aluminum. Back plate of fan wheel shall be finned to provide forced cooling of the motor compartment.

D. An insulated heat shield shall separate the ventilated motor compartment from the air stream, and a shaft seal shall prevent seepage of heat and fumes from around the shaft into the motor compartment.

E. The fan shaft shall be motor driven through a V-belt drive which shall be adjustable by varying the pitch diameter of the motor pulley. The drive shall be provided with a safety factor equal to 150% of the motor ampere nameplate rating. Provision shall be made for adjusting the V- belt tension.

F. A disconnect safety switch shall be mounted under the removable motor dome. The fan motor shall have copper windings.

G. The fan shall be provided with a bird guard constructed of stainless steel expanded metal.

H. Provision shall be made in the unit design for ready access for cleaning and for serving all components and accessories. Provide hinged curb cap with stay brace to fit onto curb.

*I. The fan shall be provided with multi-leaf, interconnected, aluminum roll formed, self-acting backdraft dampers. Damper rods shall rotate in nylon bearings. Dampers shall operate with no chatter or vibration.

J. An integral grease trough shall be provided on the fan base for applications on Type I kitchen ventilators, as well as a vented curb extension.

K. Special motors for high heat and explosion-proof shall be provided where indicated in the schedule.

L. The exhaust fan unit shall be AMCA certified and shall be as manufactured by Penn Ventilator Company, Loren Cook, Acme, Greenheck, American Coolair/ILG, Breidert, Hartzell.

PART 3 – EXECUTION

3.1 FANS, EQUIPMENT AND ACCESSORIES

A. Install in accordance with manufacturer's details and instructions.

B. Mount fan speed control at the fan to facilitate mechanical balancing. Power wiring shall be part of the work of Division 26.

C. Perform field mechanical balancing in accordance with Section 23 05 93.

D. Install units in accordance with manufacturer’s installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer’s recommended clearances.

E. Support: Install and secure roof curb structure, in accordance with National Roofing Contractor’s

Association (NRCA) installation recommendations and shop drawings. Install and secure units on curbs and coordinate roof penetrations and flashing.

F. The Mechanical Contractor shall own as a part of his work, the following:

Provide one (1) additional drive set, if necessary, to obtain final design balancing requirements. The Mechanical Contractor shall coordinate with Balancing Firm and equipment manufacturer for drive selection, including belts and pulleys.

END OF SECTION

SECTION 23 72 00

AIR-TO-AIR RECOVERY EQUIPMENT

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the contract, including the conditions of the contract (General, Supplementary and other Conditions, if any) and Division 1 as appropriate, apply to the work specified in this section.

B. Refer to Section 23 00 00 for HVAC General Provisions

C. Refer to Section 23 05 00 for HVAC Basic Materials & Methods.

D. Refer to Section 23 23 00 for Refrigeration Piping.

1.2 DESCRIPTION OF WORK

A. This Section includes work necessary and/or required and materials and equipment for construction of a complete system. Such work includes, but is not limited to the following:

1. Heating and Ventilating Units
2. Packaged Air-to-Air Energy Recovery Unit
3. Single Packaged, Gas-Fired Rooftop Air Conditioning Unit
4. Packaged Gas-Fired Rooftop Unit (Kitchen Ventilation)

1.3 REFERENCE STANDARDS

A. Refer to Section 23 00 00 for a general description of requirements applying to this section.

B. AMCA Standards 210 and 300 for fans.

C. ARI Standard 410, ASHRAE Standard 33 for Heating and Cooling Coils.

D. ASHRAE Standard 52.2 and U.L. Standard 900 for media type air filters.

E. AMCA Standard 511 and 500D for Air Control Dampers.

F. AMCA Standard 611 and 610 for air flow measurement stations.

G. ARI Standard 1060 and ASHRAE Standard 84 for Air-to-Air Energy Recovery Equipment.

H. ARI Standard 260 and 430 for Air Handling Units.

1.4 QUALITY ASSURANCE

A. Refer to Section 23 05 00 for a general description of requirements applying to this Section.

B. Whenever a variable frequency PWM drive is installed to control an AC motor, a maintenance-free, circumferential, conductive micro fiber shaft grounding ring shall be installed on the AC motor drive end to discharge shaft currents to ground. Recommended part: AEGIS SGR™ Bearing Protection Ring, as made by Electro Static Technology. Install in accordance with the manufacturer's written instructions.

1.5 SUBMITTALS

A. Submit shop drawings in accordance with Section 23 00 00.

B. Submit shop drawings and descriptive date for all equipment specified in this section.

1.6 SUBSTITUTIONS

A. The listed equivalent or substituted manufacturers along with the bidding related contractor shall be completely responsible to comply with all requirements on all contract documents. This shall include, but not limited to, space requirements, code clearances, the type, horsepower, capacities, number and

size of services required from other trades, including all required ancillary items provided by other trades. If the manufacturer or related bidding contractor does not comply with these requirements, this Contractor shall be responsible for any and all additional costs associated with the changes required by other trades.

1.7 WARRANTY/GUARANTEE

A. All work and materials are subject to the general warranty as described in the General Conditions of the Contract and in Division 1, General Requirements. In addition, the following special guarantee applies:

1. Each compressor unit shall be provided with manufacturer's five (5) year parts and labor warranty.

PART 2 – PRODUCTS

2.1 HEATING AND VENTILATING UNITS

A. The air handling units for heating and ventilating shall be sectional component type. Components shall include fan section, heating coil section, and air filters.

B. The fan section shall consist of a rectangular steel cabinet, incorporating single or multiple centrifugal fans mounted on a cold rolled steel shaft which shall rotate in grease lubricated ball bearings. The fan wheels shall be multi-blade forward, backward inclined or air foil as required by conditions listed on schedule. Fan ratings shall be based on AMCA Standards 210 and 300. Fans shall bear the AMCA seal.

1. Fan and fan motor shall be internally mounted and isolated on a full width isolator support channel using 1” springs. The fan discharge shall be connected to the fan cabinet using a flexible connection to ensure vibration-free operation. The isolator support rail shall be structurally supported from the unit base.

2. Fan motors shall be NEMA design ball bearing type with electrical characteristics and horsepower as specified on the schedule. Motors shall be 1750 RPM, open dripproof type. All motors shall be high efficiency.

3. The motor shall be mounted on the same isolation base as the fan. The motor shall be on an adjustable base.

4. Fan bearings shall be self-aligning, pillow block or flanged type regreaseable ball bearings and shall be designed for an average life (AFBMA L50) of at least 200,000 hours. All bearings shall be factory lubricated and equipped with standard hydraulic grease fittings and lube lines extended to the motor side of the fan.

5. Fan drives shall be selected for a 1.5 service factor and anti-static belts shall be furnished. All drives shall be adjustable pitch.

6. Fan shafts shall be selected to operate well below the first critical speed and each shaft shall be factory coated after assembly with an anticorrosion coating.

C. The fan shaft shall be motor driven through a Vee-belt drive. The drive assembly shall be designed for not less than 150% of the motor ampere rating. Adjustment of belt tension shall be by means of an adjustable motor base. The drive assembly shall conform to A.R.I. Standard 435-78. The drive sheave shall be variable pitch type where it falls between limits of A.R.I. Standard 435-78. Outside the established limits an initial and a final set of fixed drives shall be required. Fan motors shall have copper windings.

D. Heat transfer coils shall be non-ferrous tube-in-fin type. The tubes shall be seamless copper with a wall thickness not less than 0.024 inch. The fins shall be rectangular plate type of aluminum with a thickness of not less than 0.009 inch. The tube openings in the fins shall be die-formed to provide a spacing collar between adjacent fins. The tubes shall be mechanically expanded into the fins to form

tight permanent mechanical joints. The tubes shall be silver-alloy brazed into heavy wall thickness copper or brass tubular headers.

E. Hot water heating coils shall have tube diameters of approximately 1/2 inch and shall be arranged in the required serpentine circuits. The assembled coils shall be pressure tested at 400 psig hydrostatic pressure and 200 psig air under water.

F. Coil face and bypass section shall be provided for units with high percentage of outside air as called for in unit schedule.

G. Air filters shall be 2 inches thick arranged in modular sizes to be readily removable through a hinged access door. Air filters shall be MERV 8.

H. The exterior and interior of the casing shall receive a rust and corrosion resistant finish.

I. The heating and ventilating units shall be manufactured by Trane Co., York/Johnson Controls, American Air Filter, Carrier.

1. Any listed equivalent manufacturer and the Mechanical Contractor shall be completely responsible to comply with all requirements on the contract documents. This shall include, but not be limited to, space requirements, code clearances, the type, horsepower, capacities, number and size of services required from other trades.

2.2 PACKAGED AIR-TO-AIR ENERGY RECOVERY UNIT

A. Factory fabricated and assembled unit consisting of constant volume fans, motors, and drive assemblies, coils, plenum casing, filters, energy recovery wheel (with motor and drive), flat plate energy recovery heat exchanger, motor-operated outside air and exhaust air dampers, access doors and operating controls.

B. Casing:

1. Casing panels shall consist of dual wall, minimum 18-gauge galvanized solid exterior skins and 22-gauge galvanized steel solid interior skins enclosing 2" thick 1.5 pcf fiberglass insulation with a minimum R-value of 10 which meets NFPA 90A and UL181 test standards. All metal-to-metal surfaces exposed to the weather shall be sealed airtight with maximum leakage not-to-exceed 2% at external static pressure of 3” W.C.

2. Removable panels shall be provided for energy recovery wheels, and fans. The housing shall be supported by an all-welded epoxy-painted structural base. Lifting lugs shall be welded to the base. All frame and panel members shall be G90 galvanized steel.

3. Access to all internal devices and sections shall be provided through hinged, sealed doors. Access doors shall be constructed of the same materials as the unit casing. Each door shall be provided with two cam type handles and two heavy duty hinges to achieve maximum sealing. Handles are to be internal and external for opening from the inside or outside of the unit.

4. The unit's duct connections shall be arranged to require only minor ductwork offsets or transitions to the packaged heating/cooling unit.

5. Unit features and casing shall be of weatherized construction including:

a. Continuous 18 gauge galvanized steel, pitched watertight roof with standing seams.

b. Gasketed sections requiring no caulking at the job site.

c. Internal galvanized steel drain pans in each section.

C. Fans:

1. Fan ratings are based on tests made in accordance with AMCA Standard 210 and shall bear the AMCA Seal. Fans shall be of the centrifugal type, designed with a scroll type housing. Fans shall incorporate a wheel, structural steel frame and shaft and bearings in the AMCA Arrangement 3

configuration to form a heavy-duty integral unit. All fan wheels shall provide stable flow and high rigidity. The wheels shall be non-overloading type. The blades shall be continuously welded, die-formed backward curved type, designed for maximum efficiency and quiet operation. Impellers shall be statically and dynamically balanced and the complete fan assembly shall be test balanced at the operating speed prior to shipment.

2. Shafts shall be AISI hot rolled steel accurately turned, ground, polished, and ring gauged for accuracy. Shafts shall be sized for first critical speed of at least 1.43 times the maximum speed for the class.
3. Bearings shall be heavy duty, grease lubricated, anti-friction ball or roller, self-aligning, pillow block type and selected for minimum average bearing life (AFBMA L-10) in excess of 100,000 hours at the maximum class RPM.
4. Fans shall be mounted on vibration bases with adjustable motor bases, V-belt drives, minimum 1" static deflection spring isolators, and flexible connections. Belts shall be designed for a minimum 1.5 service factor. Drives for motors shall be variable pitch.
5. Motors shall be standard NEMA frame, design B high efficiency, with 1.15 service factor and open drip-proof enclosures. Motor selections shall be non-overloading over the fan curve from 0 to 150% of design flow, and the design BHP shall not be above 90% of motor horsepower at design condition.

D. Total Energy (Enthalpy) Recovery Wheel:

1. The rotor media shall be made of aluminum which is coated to prohibit corrosion. All media surfaces shall be light weight polymer coated with a permanently bonded Silica gel desiccant prior to being formed into the honeycomb media structure to ensure that all surfaces are coated and that adequate latent capacity is provided. Desiccant coatings that must be reapplied over time are not acceptable.
2. Sensible and latent recovery efficiencies shall be clearly documented through a certification program conducted in accordance with ASHRAE 84-1991 and the results shall be presented in accordance with ARI 1060-2000 Standards. The certification shall have been conducted by the unit manufacturer.
3. Wheel testing to document that the desiccant material utilized does not transfer pollutants typically encountered in the indoor air environment shall be provided. The cross-contamination and performance certification reports shall be provided for as part of the submittals for this project.
4. The media shall be cleanable with low temperature steam, hot water or light detergent, without degrading the latent recovery. Dry particles up to 650 microns shall pass freely through the media.
5. Rotor System:
   a. Seals: The rotor shall be supplied with diameter and perimeter seals which shall not make contact with any rotating surface of the exchanger rotor face.
   b. Rotor Support System: The rotor media shall be provided in segmented fashion to allow for field erection or replacement of one section at a time without requiring side access. The media shall be rigidly held by a structural spoke system made of stainless steel.
   c. Rotor Housing: The rotor housing shall be a structural framework which limits the deflection of the rotor due to air pressure loss to less than 1/32". The housing shall be made of galvanized steel to prevent corrosion. The rotor shall be supported by two pillow block bearings which can be maintained or replaced without the removal of the rotor from its casing or the media from its spoke system. Bearings shall be selected for an L-10 life in excess of 30 years.

d. Drive System: The rotor shall be driven by a self-adjusting flexible, circumferential belt system. A/C motors shall be utilized.

e. Assembled system shall incorporate the complete wheel assembly, seals, drive motor and belts in an insulated cassette frame within a slide-out track.

E. Filters:

1. Provide filters for both inlet air streams, outside air and return air..
2. Filters shall be disposable 2" thick, MERV 8. The filter shall be listed by Underwriters' Laboratories as Class 2.
3. Provide a bank of galvanized universal holding frames arranged for upstream access.

F. Electrical: 460 volt, 3 phase, 60 Hz; electrical features shall include single point power feed termination, unit-mounted lockable disconnect, internal circuit breaker type overload protection, starters, 24 VAC control transformer and fusing.

G. Connections: System field connections shall be limited to:

1. Supply air duct connection from the packaged unit.
2. Return air duct connection to the packaged unit.
3. Field supplied power source.
4. Twisted pair, ATC communications wiring.
5. Coil piping connections for water system piping and condensate drain.

H. Coil Section:

1. Provide coil section with auxiliary cooling and heating coils to maintain scheduled air conditions leaving the unit.
2. Condensate drain pan shall be constructed of galvanized steel.
3. Heating and Cooling Coils:

a. Coils shall be furnished to meet the performance requirements set forth in the schedule. All coils shall have performance certified in accordance with ARI Standard 410.

b. Coil casing to be constructed of 16-gauge galvanized steel with aluminum die-formed corrugated fins and guide channels to create turbulent wiping behind the tubes with collars drawn and belled. The copper tubes are to be firmly bonded to the fins by mechanical expansion.

c. Drainable water coils shall be designed to operate at 250 psig design working pressure and up to 200°F and shall be tested with 325 psig compressed air under water. Circuiting shall provide free draining and venting when installed, counter flow of air and water, with water velocities not to exceed 7 feet per second and without exceeding the water pressure drops scheduled. All coils must have same end connections regardless of the number of rows deep. Provide a ¼” FPT, plugged vent or drain tap on each connection.

d. Coil connection shall stub through the interior partition wall between the supply and return air tunnels. Field piping to the coils shall extend down through the bottom pan of the unit within the unit roof curb. Pipe sleeves shall be sealed airtight.

I. Roof Curb: Prefabricated galvanized steel mounting curb shall be provided for field assembly on the roof decking prior to unit placement. The roof curb shall be a perimeter type with complete perimeter support of the air handler unit. The curb shall be a minimum of 12” high. Gasketing shall be provided for field mounting between the unit base and roof curb. Curb shall include a 2” x 4” wood nailer.

J. Manufacturers: Basis of design, Greenheck. Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work are limited to one of the following:

Addison

Annexaire

CanFab, Inc.

Desert Aire

Greenheck

Innovent

Loren Cook

Temtrol

Thybar Corp.

Valent

VenMar

1. Any listed equivalent manufacturer and the Mechanical Contractor shall be completely responsible to comply with all requirements on the contract documents. This shall include, but not be limited to, space requirements, code clearances, the type, horsepower, capacities, number and size of services required from other trades.

2.3 SINGLE PACKAGED, GAS-FIRED ROOFTOP AIR CONDITIONING UNIT

A. Refrigeration System:

1. One independent refrigeration circuit with hermetic compressor, crankcase heater, strainer, high and low pressure control, compressor motor protection, and access valves.
2. A direct expansion, draw-thru evaporator coil shall be circuited so that its entire fin surface will be active during part load operation.
3. Draw-thru condenser coils with a separate sub-cooling circuit for each refrigeration system shall provide at least 15 F of sub- cooling at design conditions.
4. Outdoor air thermostats shall cycle the condenser fan motors to maintain stable operation at ambient temperature down to 35 deg. F. Condenser fan motors shall have inherent protection.

B. 100% Outdoor Air (Economizer Package):

1. Outdoor and return air dampers shall be interlocked in position by a fully modulating damper actuator. Actuator shall be spring return so that the outdoor air intake dampers will close when power to the unit is interrupted.
2. Maximum leakage rate for the outdoor air intake dampers shall not exceed 2% when fully closed and operating against a pressure differential of 0.5”WC.
3. A unit-mounted potentiometer shall be provided to adjust the outdoor and return air damper assembly to take in minimum scheduled or 10% CFM of outdoor air.
4. During economizer operation, a mixed air temperature control shall modulate the outdoor and return air damper assembly to prevent the supply air temperature from dropping below 55 deg. F.
5. Changeover from mechanical refrigeration to economizer operation shall be provided by enthalpy control.
6. The outdoor intake opening shall be covered with a birdscreen and a rain-hood that matches the exterior of the unit.

C. Exhaust Air Relief Dampers:

1. Economizer shall be equipped with barometric dampers that will open to exhaust return air as more outdoor air is supplied to the conditioned space during economizer operation. This relief shall prevent the conditioned space from over-pressurizing during economizer operation.
2. Exhaust air opening shall be covered with a birdscreen and a rain hood that matches the exterior of the unit.

D. Filters shall be 2" thick replaceable type MERV 8 and internal metal frame work.

E. A 1,750 rpm single supply air blower motor shall have a 1.15 service factor, solid base, Class B insulation and ball bearings with permanent lubrication. All belts and pulleys shall be treated with permanent lubrication. All belts and pulleys shall be rated at least 25% above the nominal drive horsepower. The fan shaft ball bearings shall have minimum average bearing life (AFBMA L-10) in excess of 100,000 hours at the maximum class RPM.

F. Roof Curb:
1. Roof curb shall be supplied by the unit manufacturer to provide a watertight seal between the roof and the unit.
2. Roof curb shall be approved by the National Roofing Contractor's Association.
3. Roof curb shall be full perimeter with all utility and duct connections within the perimeter of the curb eliminating the need for other roof penetrations.

G. Unit Construction:
1. All sheet metal parts shall be constructed of a zinc coated, commercial grade galvanized steel. All external surfaces shall be finished with a UL approved coating system.
2. Removable side panel shall provide easy access for maintenance, service and adjustment.
3. Unit shall be single wall construction with foil faced insulation such that insulation is not exposed to the air stream.
4. Unit shall have lifting lugs on each of the four upper corners.
5. Condenser coils and fan discharge shall be protected by heavy duty wire guards.

H. Basic Safety/Operating Controls - Unit manufacturer shall supply the following safety/operating control features:
1. A firestat to deenergize the unit if the temperature of the air returning to the unit rises to 145 deg. F.
2. A thermostat to deenergize the compressors when the suction line temperature drops below 22 deg. F.
3. A five minute timer to prevent the compressor from short cycling.
4. A lock out circuit to prevent the compressors from cycling on one of their safety controls.
5. A cutout to protect the compressors during abnormally low voltage conditions.

I. Unit shall be completely factory wired, piped, charged and tested by the manufacturer before shipment.

J. Gas Heating Section:
1. Manufacturer shall furnish a natural gas furnace constructed of 20 gauge aluminized steel tubes.
2. Furnace shall include the following controls and safety devices:
   a. Intermittent spark ignition with two stage gas valve with pressure regulator.
   b. Centrifugal blower to maintain positive flue pressure with air pressure safety switch.
   c. Electronic ignition with flame sensor and lockout safety valve.
   d. High temperature limit thermostat with automatic reset.

K. Thermostat: Manufacturer shall furnish a multi-stage heat/cool thermostat for remote wall mounting with sub-base for automatic/manual changeover and seven day programmable setback control.

L. Manufacturer: Trane, York/Johnson Controls, Carrier, Daikin McQuay.

M. Manufacturer shall furnish start-up.

1. Any listed equivalent manufacturer and the Mechanical Contractor shall be completely responsible to comply with all requirements on the contract documents. This shall include, but not be limited to, space requirements, code clearances, the type, horsepower, capacities, number and size of services required from other trades.

2.4 PACKAGED GAS-FIRED ROOFTOP UNIT (KITCHEN VENTILATION)

A. Unit Construction:

1. All sheet metal parts shall be constructed of 18-gauge commercial grade galvanized steel. All external surfaces shall be finished with manufacturer's standard color enamel coating system.
2. Removable side panel shall provide easy access for maintenance, service and adjustment of components within the supply fan section and filter/damper section.
3. Unit shall be single wall construction with foil faced insulation minimum 1" thick fiberglass pinned to housing and designed for NPFA 90A requirements.
4. Unit shall have lifting lugs on each of the corners, factory assembled, except where larger units require two-piece shipment.
5. Modular sections shall include insulated downturn supply plenum, gas-fired heater section, supply fan, filter/damper section and air intake section.
6. All modules shall be of weatherproof design, joined with Ductmate connectors.

B. Outdoor Air/Filter/Damper Section:

1. Outdoor air damper shall be controlled by a factory mounted and wired damper actuator. Actuator shall be spring return so that the outdoor air intake damper will close when power to the unit is interrupted. Damper actuator shall be mounted inside housing.
2. Maximum leakage rate for the outdoor air intake dampers shall not exceed 2% when fully closed and operating against a pressure differential of 0.5" W.C.
3. The outdoor intake opening shall be covered with a removable inlet birdscreen and a rain hood that matches the exterior of the unit.
4. Filters shall be 2" thick replaceable type MERV 8 and internal metal frame work.

C. A 1,750 rpm single supply air blower motor shall have a 1.15 service factor, solid base, Class B insulation and ball bearings with permanent lubrication. All belts and pulleys shall be treated with permanent lubrication. All belts and pulleys shall be rated at least 65% above the nominal drive horsepower. The fan shaft ball bearings shall have an average life rating of 100,000 hours of operation. Fan shaft shall be machined from SAE 1020 cold rolled steel. Fans shall be FC Type, DWDI design. Fan and drive assembly shall be mounted on rubber isolators with adjustable motor base.

D. Roof Curb:

1. Roof curb shall be supplied by the unit manufacturer to provide a watertight seal between the roof and the unit.
2. Roof curb shall be approved by the National Roofing Contractor's Association.
3. Roof curb shall be full perimeter with all duct connections within the perimeter of the curb eliminating the need for other roof penetrations.

E. Gas Heating Section:

1. Manufacturer shall furnish a natural gas furnace AGA labeled and constructed of 20 gauge Type 409 stainless steel tubes. Provide Type 409 stainless steel flue collector and side vent with cap.
2. Furnace shall be as manufactured by Sterling and include the following controls and safety devices:
   . Intermittent spark ignition with two stage gas valve with pilot gas valve pressure regulator.
   b. Centrifugal blower to maintain positive flue pressure with air pressure safety switch.
   c. Electronic ignition with flame sensor and lockout safety valve.
   d. High temperature limit thermostat with automatic reset.
   e. 24 volt control voltage.

F. Unit shall be completely factory wired, piped and tested by the manufacturer before shipment.

G. Unit-mounted motor control center shall be factory installed, wired and include the following components:

1. Single point power connections within NEMA 3R enclosures for fused disconnect switch and motor controls.
2. Magnetic contactors with overload protection in all legs.
3. Resets for supply and exhaust fans, with interlocking contactor, additional contactor for motor-operated outside air damper.
4. Fused transformer to provide secondary 24 VAC control voltage for heater section control and control panel on face of kitchen hood. Electronic modulating discharge temperature control with internal setpoint selector.
5. All components U.L. listed or classified and wired per N.E.C.

H. Exhaust fan section shall be factory mounted and wired. Fan shall be as scheduled on drawings and as specified in Section 23 34 00.

I. Accessories:

1. Remote discharge air temperature setpoint controller for field mounting. Control interface with unit-packaged control center shall be part of the work of Division 23- Mechanical.
2. Provide 24VAC control voltage relays for interface between unit packaged control center and heat detectors furnished with the kitchen type I ventilator package for automatic operation of the makeup air unit and its associated ventilator exhaust fan.

J. Manufacturer: Kees, Inc., Greenheck, Captive Aire, Weather-Rite.

1. Any listed equivalent manufacturer and the Mechanical Contractor shall be completely responsible to comply with all requirements on the contract documents. This shall include, but not be limited to, space requirements, code clearances, the type, horsepower, capacities, number and size of services required from other trades.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Verify that coils, filters, motors, drives and other components are matched with the proper unit.

B. Assemble unit components following manufacturer's instructions for handling, testing and operation. Repair damaged galvanized areas, and paint in accordance with manufacturer's written recommendations.

C. Vacuum clean interior of units prior to operation.

D. Repair air leaks from or into casing that can be heard or felt during normal operation.

E. Install rooftop units in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.

F. Support: Install and secure roof curb to roof structure, in accordance with National Roofing Contractor's Association (NRCA) installation recommendations and shop drawings. Install and secure rooftop units on curbs and coordinate roof penetrations and flashing.

G. Perform field mechanical balancing in accordance with Section 23 05 93.

H. The Mechanical Contractor shall own as part of his work, the following:

Provide one (1) additional drive set, if necessary, to obtain final design balancing requirements. The Mechanical Contractor shall coordinate with Balancing Firm and equipment manufacturer for drive selection, including belts and pulleys.

I. Provide certified factory start-up and written report on all units.

3.2 AUTOMATIC TEMPERATURE CONTROLS

A. Coordination of control work with the BAS shall include, but not be limited to, the following items as described in Section 23 09 00.

B. Constant volume rooftop units:

1. The following items shall be provided by the equipment manufacturer:
   a. Motor starters and overload protection.
   b. Control transformers.
   c. Energy wheel motor, speed controller, defrost controller, rotation failure contact, and status contact.
   d. Dampers and damper motors.
   e. Terminal blocks for all wiring connections between equipment and control devices.
   f. Analog air filter differential pressure sensor.
   g. Manual reset freeze stat.
   h. Variable frequency drives as scheduled.
   i. Run status dry contact for each VFD.
2. The following items will be furnished by the BAS Contractor and installed by the equipment manufacturer:
   a. DDC Controller
   b. Discharge air temperature sensor.
   c. Discharge humidity sensor.
   d. Return air temperature sensor.
   e. Return air humidity sensor.
   f. Temperature sensor at exhaust air outlet.
   g. Current sensor for one phase of power feeding the supply fan, and/or unit exhaust fan.
   h. Mixed air average temperature sensor.
   i. Heating coil discharge air temperature.

3. The following items shall be field mounted and wired by the BAS Contractor:
   a. Discharge air temperature sensor.
   b. Discharge humidity sensor.
   c. Heating coil discharge air temperature sensor.
   d. Manual reset freezestat (supplied by ATC).

C. Variable Volume Rooftop Units:
1. The following items shall be provided by the equipment manufacturer:
   a. Motor starters and overload protection.
   b. Control transformers.
   c. Energy wheel motor, speed controller, defrost controller and rotation failure contact.
   d. Dampers and damper motors.
   e. Terminal blocks for all wiring connections between equipment and control devices.
   f. Analog air filter differential pressure sensor.
   g. Variable frequency drives with status/alarm feedback signal for monitoring via the BAS.
   h. Manual reset freeze stat.
2. The following items will be furnished by the BAS Contractor and installed by the equipment manufacturer:
   a. DDC Controller.
   b. Discharge air temperature sensor.
   c. Discharge humidity sensor.
   d. Return air temperature sensor.
   e. Return air humidity sensor.
   f. Temperature sensor at exhaust air outlet.
   g. Mixed air average temperature sensor.
3. The following items shall be field mounted and wired by the BAS Contractor:
   a. Discharge air temperature sensor.
   b. Discharge humidity sensor.
   c. Heating coil discharge air temperature sensor.
   d. Manual reset freezestat (supplied by ATC).

D. Rooftop Energy Recovery Units:
1. The following items shall be provided by the equipment manufacturer:
   a. Motor starters and overload protection.
   b. Control transformers.
   c. Energy wheel motor, speed controller, defrost controller and rotation failure contact.
   d. Dampers and damper motors.
   e. Terminal blocks for all wiring connections between equipment and control devices.
   f. Analog air filter differential pressure sensor, each filter bank.
   g. Manual reset freeze stat.

2. The following items will be furnished by the BAS Contractor and installed by the equipment manufacturer:
   a. DDC Controller.
   b. Unit discharge air temperature sensor.
   c. Heating and cooling coil discharge air temperature sensors.
   d. Discharge humidity sensor.
   e. Return air temperature sensor.
   f. Return air humidity sensor.
   g. Temperature sensor at exhaust air outlet.
   h. Current sensor for one phase of power feeding the supply and exhaust fans.
3. The following items shall be field mounted and wired by the BAS Contractor:
   a. Discharge air temperature sensor.
   b. Discharge humidity sensor.
   c. Heating coil discharge air temperature sensor.
   d. Manual reset freezestat (supplied by ATC).

E. The factory mounted DDC controllers shall be fully programmed with factory approved applications. Any modifications to these programs shall be done by factory trained personal or as approved by the DDC controls and unit equipment manufacturer.

The unit equipment manufacturer shall provide coordination for start-up, check-out, and test of the factory mounted DDC controllers and network devices including the protocol translator. Any hardware and software necessary including labor shall be provided by the unit equipment manufacturer.

The unit DDC controllers shall be networked to a standard protocol translator or gateway so system points shall be available for communications and control from the Building Automation System (BAS)/Automatic Temperature Controls (ATC) System. The protocols available from the protocol translator to the BAS/ATC System shall be BACNET (MSTP), LON or N2.

System points shall be configured to the BAS/ATC System by the BAS/ATC System Contractor. The mapping of points to the BAS/ATC front-end/PC shall be done by the BAS/ATC Contractor. Any software or hardware necessary including labor to accomplish this work shall be provided by the BAS/ATC System Contractor.

END OF SECTION

SECTION 23 72 23

PACKAGED AIR-TO-AIR ENERGY RECOVERY UNITS

PART 1 – GENERAL

1.1 SCOPE

A. Furnish and install where indicated, factory-assembled, enclosed swimming pool environmental control/ energy recovery system. System shall include,

B. Split system designed for natatorium environment control including:

1. Dehumidification
2. Unit mounted indirect fired natural gas heater for space heating
3. Cooling mode with heat rejection to a remote outdoor air cooled fluid cooler (dry-cooler). No site refrigeration work shall be required.
4. Pool water heating from vented heat exchanger from reclaimed compressor waste heat
5. Unit mounted minimum Exhaust Fan with airflow measuring stations and Purge/Economizer Fan
6. Unit mounted minimum Outdoor Air Connection with outside air measuring elements
7. Purge/Economizer

1.2 QUALITY AND SAFETY ASSURANCE

A. The unit shall be ETL listed.

B. Unit shall be completely factory assembled, wired, piped, and test run prior to shipping. All controls shall be factory adjusted and preset to the design conditions. A factory test report shall be available upon request.

C. Live remote monitoring of the unit during factory testing shall be available via the Internet.

D. The unit shall have a mechanical vestibule where the electrical panel, compressors, pool water heat exchangers, receivers and most of the refrigeration controls are out of the process air stream.

E. Unit shall have a microprocessor controller with unit mounted refrigerant pressure transducers on each independent compressor circuit, multiple temperature sensors and an Ethernet connection for factory monitoring, adjusting and control via the internet. The refrigerant pressure transducers shall be actively used for unit control. A weekly graph of the space conditions shall be provided to the customer. Demonstration of these capabilities must be carried out at the engineer's office prior to bid day.

F. Internet Start-Up assist: The unit shall have remote factory start-up capability via the Internet.

G. The unit shall have 24-7 remote computer monitoring with automated alarm notifications and system performance alerts.

H. Warranty: The entire system shall have a 24-month limited parts warranty from ship date.

1. The system shall be covered by an additional 1-year labour warranty when it is connected to the factory via live internet monitoring system from date of initial start-up.
2. The compressor(s) shall have a 5-year warranty from ship date.

I. The unit shall have live remote service capability via the internet with the ability for field service technicians to receive service and trouble alerts via email and make adjustments via smart-phone application remote control.

J. The unit shall have real-time airflow control using flow sensors, variable speed fans, and dampers. Proper airflow is maintained continuously, even as filters load, etc.

PART 2 – PRODUCTS

2.1 GENERAL

A. The natatorium control system shall include:

1. Mechanical process dehumidification
2. Outdoor configuration
3. The unit shall have an indirect fired natural gas heater installed downstream of the blower, sized to meet the skin losses and outdoor air heating loads or as specified by the design engineer.
4. Pool water heating type: potable water rated coaxial
5. Air filtration type: MERV 8 2-inch filters for return and outdoor air.
6. Purge mode and economizer mode.
7. Minimum Exhaust Fan with airflow measuring stations. Purge/Economizer Exhaust Fan.
8. Programmable microprocessor controller with Live, 24-7 remote internet access, monitoring and control.
9. Remote operator panel
10. Unit shall have a service vestibule where the compressor, refrigeration specialties and control valves and all electronics are outside of process air stream.
11. Outside air measuring elements

2.2 SEQUENCE OF OPERATION

A. Unit shall be designed and sized to maintain the specified conditions. The unit operation shall be as follows:

1. Unit Startup
   a. Power is turned on or system is restarted.
   b. After a short initial delay to allow sensors to stabilize, the blower starts and operates continuously.
   c. Based on unit mounted sensor feedback the unit shall begin/resume operation and will operate based on the sequence described below.
2. Airside Configuration
   a. The unit delivers specified supply air continuously to the Natatorium.
   b. The minimum exhaust air flow is actively controlled to meet the engineer’s schedule.
   c. The minimum outdoor air flow is actively controlled to meet the engineer’s schedule.
3. Dehumidification Mode
   a. Return air dewpoint is above dewpoint setpoint.
   b. Compressor starts using Compressor Start sequence.
   c. If the unit cannot maintain relative humidity within setpoint, compressor 2 will start.
   d. The compressor waste heat is rejected into the glycol fluid loop which flows in parallel to the reheat coil and air conditioning air cooled heat exchanger.
   e. The reheat coil has full (0-100%) modulating capabilities. The reheat output will modulate to maintain the space temperature at set point year round.
4. Air Conditioning Mode
   a. Return air temperature is above room temperature setpoint.

b. Compressor starts if not already operating in dehumidification mode.

c. Unneeded compressor hot gas is diverted to a refrigerant to glycol fluid cooled heat exchanger. Up to 100% of compressor heat is rejected into the glycol fluid which in turn is pumped outdoors to an outdoor air cooled heat exchanger for 100% heat rejection at summer design ambient conditions.

d. 100% of compressor heat is rejected at the outdoor air cooled heat exchanger on a summer design day. On off peak days the reheat output will modulate to maintain the space temperature at set point year round.

e. If the unit cannot maintain return air temperature within setpoint, compressor 2 will start.

5. Space Heating Mode

a. Return air temperature is below room temperature setpoint.

b. The Microprocessor space heating output signal (0-10 volt) is sent to the heating coil controller. The signal output will regulate based on the return air temperature.

6. Pool Water Heating Mode

a. Return pool water temperature is below pool water setpoint.

b. If compressor is already operating from a Dehumidification or Air Conditioning demand, the control valves divert the compressor hot gas through the coaxial heat exchanger/pool water heater and the rest of the compressor heat is rejected at either the reheat coil or the AC heat exchanger.

c. If there is no pre-existing demand for the compressor to operate, the microprocessor sends a signal to the auxiliary pool water heater (remote by others) to operate. The compressor will not normally operate solely for a pool water heating demand unless configured to do so at the controller.

7. Purge Mode

a. This mode is manually triggered by an operator when super-chlorinating the pool. It can be triggered at the operator panel (unit mounted or optional remote), Virtual-Tech or BACnet.

b. It has an adjustable timed duration after which the system automatically resumes normal operation.

c. Once triggered by the operator:

(1) The compressors (if operating) pump down and cycle off.

(2) Signal from the microprocessor sets the exhaust fan(s) to maximum CFM.

(3) The unit mounted outdoor air dampers open fully. The return air dampers close.

(4) The system is in 100% outdoor air ventilation mode.

(5) After time period expires, all dampers and fans return to normal operating settings and the unit resumes normal operation.

(6) Unit will control heating based on supply air temperature.

8. Economizer Cooling Mode

a. Return air temperature is above room temperature setpoint.

b. The microprocessor will compare the temperature of the outside air with the cooling setpoint.

c. When outside air as determined to be suitable by the microprocessor, it will be used as the first source of cooling.

d. Unit will switch over to using compressor(s) if outside air cannot satisfy the space temperature conditions.

9. Economizer Dehumidification Mode
   a. Return air dewpoint is above dewpoint setpoint.
   b. The microprocessor will compare the moisture content of the outside air to the dehumidification setpoint.
   c. When outside air as determined to be suitable by the microprocessor, it will be used as the first source of cooling.
   d. Unit will switch over to using compressor(s) if outside air cannot satisfy the space humidity conditions.
10. Freeze Protection
   a. Supply air temperature falls below freezestat setpoint or optional freezestat sensor indicates a freezestat condition.
   b. All exhaust fans are stopped and all outdoor air dampers are fully closed.
   c. Freezestat alarm is tripped. Alarm has to be manually cleared by operator.

2.3 Cabinet

A. The Cabinet shall be designed for Outdoor installation and shall be 2" double walled with painted inner liner.

B. Cabinet Construction: All cabinet 16, 20, 24 gauge sheet metal shall be galvanized G90 steel or GalvalumeTM alloy, mill applied zinc phosphate primer followed by an exterior grade white silicone modified polyester top coat. The sheet metal is engineered to form a cabinet with maximum strength and rigidity. Panels shall be fastened to the frame with stainless steel hardware. Panels shall be isolated from the steel frame with dielectric gaskets to prevent galvanic corrosion. All seams shall be caulked with silicone inside and out to prevent air and water leakage.

1. Base Rails: The unit base frame shall be formed of 2 layers of 10 gauge galvanized steel. Lifting lugs shall be provided on the base frame for rigging the unit.
2. The cabinet walls shall be 20 gauge pre-painted steel, 2-inch double-wall construction with a fully painted inner metal liner and 2-inch fiberglass insulation.
3. The cabinet floor shall be comprised of a 16-gauge galvanized steel panel with a 20-gauge pre-painted steel inner liner, 2-inch double wall engineered with structural bending for maximum rigidity and be mechanically fastened to the base frame of the unit.
4. The cabinet roof shall be 20-gauge pre-painted steel, 2-inch double wall engineered with structural bending for maximum rigidity and be mechanically fastened to the base walls of the unit.
5. The cabinets shall be mechanically assembled with stainless steel 5/32" sealed pop rivets. Where bolts are required bright zinc plated bolts shall be used.
6. Access doors shall be supported on multiples hinges and have multiple compression latches to provide quick access. Doors shall be provided for entrance to all sections housing components requiring routine maintenance. Full height access doors have "hold back" latches to prevent door closure during the performance of service procedures.
7. The unit shall have non-corroding protective mesh screens on all air intake openings.
8. The units shall have non-corroding protective mesh screens covering internal fan blades, protective grates covering all floor access ports.

C. Outdoor Air Intake:

1. Purge /Economizer and Minimum Outdoor Air connections with motorized dampers and controls.
2. Minimum outdoor air intake with airflow sensing elements.

D. Insulation: The unit shall be insulated per the following standards:

1. All exterior cabinet sections shall be insulated with two (2) inch thick fiberglass inside the double walled cabinet.
2. Fire resistant rating to conform to NFPA Standard 90A and 90B.
3. Sound attenuation coefficient shall not be less than 1.02 at a frequency of 1,000 Hz as per ASTM Standard C423.
4. Thermal conductivity shall not exceed 0.26 Btu/in-h-sqft-F at 75 F.

E. Cabinet configuration shall include:

1. A filter rack with separate access doors shall be provided for the return air and minimum outdoor air streams.
2. Unit shall be equipped with a second outdoor air intake assembly with motorized 2 position extruded aluminum, Insulated, silicone side-sealed damper for Purge and Economizer operation.
3. Mechanical vestibule: The unit shall have the compressor, receiver, solenoid valves and the electrical panel in a separate compartment out of the processed air stream. All components shall be serviceable while the unit is in operation without disturbing the airflow.
4. Electrical panel: The unit shall have a built-in electrical control panel in a separate compartment in order not to disturb the airflow within the dehumidifier during electrical servicing. All electrical components shall be mounted on a 16 gauge galvanized sub-panel.

2.4 Filters

A. Filters shall be standard sized, replaceable, off-the-shelf filters used throughout including:

1. Return Air: 2-Inch MERV 8, 30% pleated filters with rust-free non-metallic structure on a face loading rack.
2. Outside Air: 2-Inch MERV 8, 30% pleated filters with rust-free non-metallic structure

2.5 Coils

A. Evaporator/dehumidifier coils shall be designed for maximum moisture removal capacity.

1. Coils shall be fully dipped and coated with a polyester/enamel coating for maximum corrosion protection. Coating shall comply with ASTM B117/D1654 and ASTM D2126 for corrosion resistance against common acids, salt and gases.
2. Coil shall have galvanized casing and end plates.
3. Aluminum fin and copper tubes mechanically bonded to assure high heat transfer.

B. Air reheat coils shall be sized for variable heat transfer into the air with a capacity of 100% of the compressors total required heat of rejection.

1. Coils shall be fully dipped and coated with a polyester/enamel coating for maximum corrosion protection. Coating shall comply with ASTM B117/D1654 and ASTM D2126 for corrosion resistance against common acids, salt and gases.
2. Coil shall have galvanized casing and end plates.
3. Aluminum fin and copper tube joints mechanically bonded to assure high heat transfer

2.6 Drain Pans

A. Each evaporator coil shall be provided with a positive draining, compound-sloped, baked powder paint coated aluminum drain pan with fully-welded corners to ensure zero water retention.

2.7 Blowers and Blower Motors

A. Supply blowers:

1. The complete blower assembly shall be statically and dynamically balanced on precision electronic balancers.
2. The blower assembly shall be mounted on a 1" deflection spring isolated rack.
3. The fan inlets shall be equipped with accidental contact protection screen.
4. Motor(s) shall be Premium efficiency painted cast iron construction TEFC, NEMA MG1-PART 31 Inverter Duty 15:1 Constant Torque Severe Duty with a service factor 1.25. Motors shall be 6 Pole 1200 RPM synchronous speed with HOA switch with motor safeties against overloading at 60 Hz operation directly on mains. Motors shall have double lip seals on both ends with regreasable bearings 254T frame and larger with Polyurea grease.

B. Exhaust blowers:

1. The exhaust blower (EF1) sized to maintain the Natatorium?s negative pressure requirement during normal operation shall be unit mounted and its operation tied to the unit's occupancy scheduler.
2. The blower shall be impeller plenum fan complete with backward curved, three-dimensional, profiled blades made of high performance composite material. The blower shall be completely corrosion resistant and be maintenance free a direct drive via a direct current (DC) electronic commuted (EC) motor. The EC-Motor shall have zero slippage design and have continuously variable speed control when connected to the unit?s controller.
3. The fan assembly shall be balanced in Class G 6.3 acc DIN ISO 1940, dymanic on two levels.
4. The fan assembly shall be suitable for ambient temperatures of -40°C to max. +70°C.
5. Thermal contacts installed in the windings compliant with THCL 155.
6. Drive motor in external rotor principle, sealed in protection class IP54 with moisture protection impregnation of the windings, topical protection.
7. High corrosion resistance design with high quality and reliability.
8. The exhaust fan shall be controlled from an end switch on the power open of the exhaust air damper. The exhaust dampers shall be protected by louvers to divert rain from the face of the dampers.
9. The exhaust fan assembly shall include airflow measuring stations.

C. Purge blowers:

1. The ventilation/economizer/purge exhaust blower (PEA) shall be unit mounted and sized to provide full exhaust from the space when operating with EF1.
2. The fan shall be direct driven axial fan made of high-strength composite material in which the motor and controller are integrated. It includes FE2owlet blades combined with guide vanes and EC commutated direct-current external rotor motors provides maximum efficiency the quietest performance. The EC motor shall have maintenance-free electronic circuitry, a rotor with permanent magnets, and an integral controller to provide the windings with electrical current so that, the motor rotates continuously and quietly. The fan is aerodynamically-optimised, sickle-blade profile, patterned with serrated trailing edge and winglets on the blade outer edge for energy and noise-optimised operation.

3. The fan assembly shall be balanced in Class G 6.3 acc DIN ISO 1940, dymanic on two levels.
4. The fan assembly shall be suitable for ambient temperatures of -40°C to max. +70°C.
5. Thermal contacts installed in the windings compliant with THCL 155.
6. Drive motor in external rotor principle, sealed in protection class IP54 with moisture protection impregnation of the windings, topical protection.
7. High corrosion resistance design with high quality and reliability.
8. The exhaust fan shall be controlled from an end switch on the power open and spring return outside air damper. The gravity exhaust dampers shall be protected by louvers to divert rain from the face of the dampers.

2.8 Dampers

A. Internal dampers shall be parallel blade and made from extruded anodized Aluminum with neoprene double seal tips to minimize leakage. Damper blades shall be mounted on steel rods which rotate on nylon bushings. All damper hardware shall be corrosion resistant.
   1. Unit shall be provided with a power open and spring return outside air and exhaust air dampers. Dampers adjust between 0% to 100% open position.
   2. Outdoor air and exhaust air dampers shall be opposed blade, power open and spring return. Dampers blades shall be 3/4? insulated type made from extruded anodized Aluminum with neoprene double seal tips to minimize leakage. Damper leakage shall be less than 1% of maximum flow at 4-inch W.C. differential. Damper blades shall be mounted on steel rods which rotate on nylon bushings. All damper hardware shall be corrosion resistant.

2.9 Minimum Outside Airflow Measuring Elements

A. The outside air shall be monitored via factory installed air monitoring stations.
B. Stations shall not require periodic calibration or maintenance.
C. Airflow monitor measurement accuracy shall be plus or minus, 2% of reading.
D. Monitors shall be constructed of anodized rods and mounting blocks shall be 304 stainless steel.
E. Shall be permanently mounted within the unit.

2.10 Pool Water Heater

A. Potable water rated coaxial type with corrosion resistant cupro-nickel water circuit tubing.
   1. Coaxial type with corrosion resistant cupro-nickel water circuit tubing.
   2. Self-purging and self-draining counter flow design.
   3. Water circuit piping shall be transparent braided hose, for visual water flow confirmation.
   4. Terminating connections are PVC schedule 40 NPT fittings located at the cabinet wall for easy connection.
   5. Maximum loop operating pressure: 60 psig

2.11 Compressors

A. Type: Scroll type, suction gas cooled, suitable for refrigerant R-410A
B. The compressors shall be mounted on rubber in shear isolators to prevent transmission of any noise and vibration to the space below.
C. Removable crankcase heater for liquid migration protection.
D. Compressors shall be located outside the conditioned air stream in the unit's service vestibule.
E. Compressors shall have a 3-year warranty extension for a total of 5 years coverage.

F. Compressor manufacturer must have a wholesale outlet for replacement parts in the nearest major city.

2.12 Refrigeration Circuit

A. The unit shall consist of two factory sealed refrigeration circuits for humidity and/or air conditioning control. No site refrigeration work shall be required.

B. Refrigeration circuit shall have pressure transducers monitoring the refrigerant high and low pressures. The refrigeration circuit shall be accessible for diagnostics, adjustment and servicing without the need of service manifold gauges.

C. Shall have solenoid control valves, check valves, a liquid line filter drier, liquid and moisture indicator, thermostatic expansion valve and pump down solenoid valve.

D. Unit shall have an externally adjustable balanced port design mechanical thermostatic expansion valve. The valve shall have a removable power head.

E. Tamper proof, hermetically sealed non-adjustable high and low pressure controls and refrigeration service valves shall be installed using Schrader type valves. Refrigeration service valves shall be located outside of the airstream.

F. Receiver shall have two refrigerant level (maximum and minimum) indicating sight glasses.

G. Suction line shall be fully insulated with ½ inch closed cell insulation.

2.13 Control Panel

A. Electrical contractor shall be responsible for external power wiring and disconnect switch fusing. Power block terminals shall be provided.

B. Shall be mounted inside the service vestibule outside of the process air stream.

C. Blower motors shall be protected with thermal trip overloads.

D. Unit shall have a voltage monitor with phase protection.

E. Available dry contacts shall include:

1. Alarm
2. Blower interlock
3. Stage 1 & 2 heating
4. Outdoor air damper control
5. Remote exhaust fan #1
6. Remote exhaust fan #2
7. Outdoor-air cooled equipment
8. System on
9. Auxiliary pool heater 1
10. Heat recovery

F. Terminals shall be provided for 24 volt power to the outdoor air cooled condenser fan contactor.

G. All wiring shall be installed in accordance with UL or CSA safety electrical code regulations, and shall be in accordance with NFPA. All components used shall be UL or CSA listed.

H. Color-coding and wire numbering shall be provided for easy troubleshooting. All wires shall be in a wire duct. Wiring diagrams located near electrical panels on unit.

I. Compressors shall have a time delay start to prevent short cycling.

J. Pressure transducers for refrigerant high pressure and suction pressure shall be provided.

K. Airflow switch and dry contact for alarm shall be provided.

L. Controls supporting airflow measurement shall be provided.

2.14 Microprocessor Control

A. A microprocessor controller with the following characteristics will be provided:

1. All set points and adjustments are preprogrammed at the factory during quality control and test operation.
2. The microprocessor program has an updatable FLASH memory.
3. The Flash memory will be updatable via an internet connection.
4. A minimum: 11 Analog inputs, 4 Analog outputs, 24 Digital inputs and 16 Digital outputs.
5. Four serial interface ports including both RS232 and RS485 types.
6. An Ethernet port with RJ-45 connector and LED activity indicator.
7. A real time clock to time stamp unit operation log with programmable 7-day occupied/unoccupied scheduling capabilities.
8. Two manual demand forced modes to allow user a manual bypass of the microprocessor in the event of controller failure.
9. Keypad and display panel shall have a backlit graphic liquid crystal display.

B. Unit shall have pressure transducers monitoring the refrigerant high and low pressures. The refrigeration circuit shall be accessible for diagnostics, adjustment and servicing without the need of service manifold gauges.

C. The following status LEDs shall be on the controller:

1. Alarm - indicates there has been a failure requiring service.
2. Dehumidification - indicates that the system is dehumidifying the space.
3. Cooling - indicates that the air-conditioning mode.
4. Pool Heating - indicates that the system is heating the pool water with recycled energy.
5. Space Heat - indicates that the space heating is operating.
6. Maintenance - indicates whether or not maintenance is required.
7. Manual - indicates that the system has been set to manual operation.

D. The following set points shall be accessible and adjustable from the display panel:

1. Space temperature
2. Space relative humidity
3. Pool water temperature
4. Supply Airflow
5. Min Outside Air %
6. Space Pressure %

E. The following sensors shall be unit-mounted and monitored at the display panel. All information from these items shall be actively used in the control and operation strategies for the unit:

1. Refrigerant high pressure
2. Refrigerant low pressure
3. Return air temperature
4. Supply air temperature

5. Return air relative humidity
6. Entering pool water temperature
7. Leaving pool water temperature
8. Evaporator leaving air temperature
9. Suction temperature
10. Discharge temperature
11. Supply Airflow
12. Min Outside Airflow
13. Min Exhaust Airflow

F. System Fault: Shall indicate via text message to the display what systems require attention or servicing. Built-in monitoring and diagnostics shall allow the user to view the following:

1. Power Failure
2. Dirty air filter
3. Refrigerant high and low pressure
4. System off
5. Anti-short cycle delay

2.15 Air Heating

A. Unit-mounted indirect fired natural gas heater shall be sized to meet the scheduled heating capacity and have the following characteristics:

1. Modulating control.
2. The heater shall be spark ignition natural gas indirect fired type with capacity as shown in this submittal and is installed 'blow through' or downstream from the blower. The heat exchanger tubes are constructed of formed and welded series 409 stainless steel, 16 gauge suitable for installation downstream of the cooling coil and satisfactory for air inlet temperatures below 40 F. The burner is the power firing type and incorporates a primary combustion air blower and spark ignition transformer.
3. The heater shall be spark ignition propane gas indirect fired type with capacity as shown in this submittal and is installed 'blow through' or downstream from the blower. The heat exchanger tubes are constructed of formed and welded series 409 stainless steel, 16 gauge suitable for installation downstream of the cooling coil and satisfactory for air inlet temperatures below 40 F. The burner is the power firing type and incorporates a primary combustion air blower and spark ignition transformer.
4. Standard controls shall include a modulating gas valve, intermittent spark ignition, overheat control, rollout flame supervision, combustion air flow proving switch, positive burner safety switch, pilot cock, main gas cock with 100% shut off, adjustable main and pilot pressure regulators.
5. The natural gas heater section shall be an ETL recognized component. The gas train shall be complete with all controls factory mounted to comply with requirements of ETL. The gas train is complete with a modulating main gas valve and is ready for connection to a natural gas supply with pressure between 7 in and 14 in WC.
6. The liquid propane heater section shall be an ETL recognized component. The gas train shall be complete with all controls factory mounted to comply with requirements of ETL. The gas train is complete with a modulating main gas valve and is ready for connection to a propane gas supply with pressure between 7 in and 14 in WC.

7. The complete unit shall be test fired and preliminary adjustments made prior to leaving the factory.

2.16 Air Conditioning

A. Air-cooled air conditioning via fluid cooler

1. Unit shall be equipped with air conditioning mode where excess compressor heat is rejected to a remote outdoor air-cooled heat exchanger (aka Dry Cooler) via a single pipe set glycol fluid loop. No site refrigeration work shall be required. The unit shall also include a circulating pump and expansion tank. The unit mounted fluid cooled condenser and remote outdoor air-cooled heat exchanger shall both be capable of rejecting 100% of the compressor heat rejection with an air on temperature at summer design conditions.
2. Unit shall be provided with a dry contact rated for 24VAC/5A to operate the remote outdoor fluid cooler control.
3. Refrigeration circuit shall include refrigerant valves, receiver with pressure relief valve set at 550 psig, pressure control valve and pressure differential valve, and two manual shutoff valves to isolate the outdoor fluid cooler.
4. Coils shall be tested at 425 PSIG and mounted vertically for complete surface utilization. Coils shall be counter flow and have adequate capacity to dissipate the total heat rejection of the system at design conditions.
5. The fan shall be a direct driven axial fan made with a dual speed external rotor motor with innovative bionic blades in die-cast aluminum moulds.
   a. The fan assembly shall be balanced in Class G 6.3 acc DIN ISO 1940, dynamic on two levels.
   b. The fan assembly shall be suitable for ambient temperatures of -40°C to max. +70°C.
   c. Thermal contacts installed in the windings compliant with THCL 155.
   d. Drive motor in external rotor principle, sealed in protection class IP54 with moisture protection impregnation of the windings, topical protection.
   e. High corrosion resistance design with high quality and reliability.

2.17 Factory Performance Testing

A. The unit shall be thoroughly tested under factory test conditions. A copy of the test report shall be available to the engineer upon request.

B. Microprocessor controls shall be factory adjusted and preset to the design conditions during testing.

C. The unit shall be accessible for real-time monitoring while in the QC test chamber upon request.

PART 3 – EXECUTION

3.1 Product Delivery, Acceptance, Storage and Handling

A. Perform a thorough physical inspection of the unit upon delivery from the shipment carrier.

B. Identify and report any physical damage immediately to manufacturer.

C. If unit is to be stored prior to installation store in a clean, dry place. Protect from weather, dirt, fumes, water, construction, and physical damage.

D. Handle unit carefully during installation to prevent damage, breaking, denting and scoring.

E. Damaged units or damaged components shall not be installed. Contact manufacturer for RMA instructions.

F. Comply with manufacturer's rigging and installation instructions for unloading the unit and moving it to the final location.

3.2 Connections

A. Where installing piping adjacent to units, allow space for service and maintenance.

B. Duct connections: Drawings indicate the general arrangements of the ducts. Connect units to ducts with flexible duct connectors. Comply with requirements for flexible duct connectors.

C. Electrical connections: Comply with requirements for power wiring, switches and motor controls in electrical sections.

3.3 Installation

A. The agency responsible for start-up should work in accordance with the specifications and in accordance with the manufacturer's instructions and only by workers experienced in this type of work.

3.4 Start Up

A. Detailed instructions for start up as provided by the manufacturer must be followed.

B. Installing contractor must contact the manufacturer prior to start up to confirm start up procedures.

C. Remote internet access and control must be initiated and confirmed by the factory prior to start up for extended labour warranty to be in effect.

END OF SECTION

SECTION 23 72 50
AIR PURIFICATION SYSTEM

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the contract, including the conditions of the contract (General, Supplementary and other Conditions, if any) and Division 1 as appropriate, apply to the work specified in this section.

B. Refer to Section 23 00 00 for HVAC General Provisions

C. Refer to Section 23 05 00 for HVAC Basic Materials & Methods.

1.2 DESCRIPTION OF WORK

A. This Section describes the design, performance and installation of an air purification system intended for use as part of another manufacturer's air handling unit as shown on the plans, details and equipment schedules.

B. This Section includes work necessary and/or required and materials and equipment for construction of a complete system.

1.3 REFERENCED STANDARDS

A. Refer to Section 23 00 00 for a general description of requirements applying to this section.

B. The following codes and standards are referenced through out. The edition to be used is that currently enforced by the authority having jurisdiction (AHJ) or in absence of such direction that referenced by the current enforceable IBC code or as indicated by the contract documents, except where specifically referenced by this section of the specifications.

1. ASHRAE Standards 62 & 52
2. National Electric Code NFPA 70
3. UL 867-2007 including ozone chamber test required as of December 21, 2007
4. UL 2998 Environment – No Ozone Certification
5. The cold plasma equipment and power supply shall be UL listed.
6. The technology shall have been tested to DO-160 by an independent lab and successfully passed all requirements for shock, vibration, EMF and line noise. Manufacturers not tested to DO-160 shall not be acceptable. DO-160 is normally used to test devices in aviation applications, but this standard is applicable to confirm EMF and line noise in HVAC applications.

1.4 QUALITY ASSURANCE

A. Refer to Section 23 05 00 for a general description of requirements applying to this Section.

B. Basis of design is Global Plasma Solutions. The Air Purification System shall be a product of an established manufacturer within the USA. Direct Current (DC) Ion modules manufactured outside the USA and assembled in the USA on mounting plates or formed channels shall not be acceptable.

C. A qualified representative from the manufacturer shall be available to inspect the installation of the air purification system to ensure installation in accordance with manufacturer's recommendation.

D. Technologies that do not address gas disassociation such as UV Lights, Powered Particulate Filters and/or polarized media filters shall not be considered. Uni-polar ion generators shall not

be acceptable. “Plasma” particulate filters shall not be acceptable. Any system containing titanium dioxide (Ti02), which has been listed by the CDC as a known carcinogen, shall not be acceptable.

E. Projects designed using ASHRAE Standard 62, IAQ Procedure shall require the manufacturer to provide Indoor Air Quality calculations using the formulas within ASHRAE Standard 62.1-2007 to validate acceptable indoor air quality at the quantity of outside air scheduled with the technology submitted. The manufacturer shall provide independent test data on a previous installation performed within the last two years and in a similar application, that proves compliance to ASHRAE 62 and the accuracy of the calculations. The data shall be based on the manufacturer’s use of the same make and model number as the equipment submitted on this project.

F. The Air Purification Technology shall have been tested by UL to prove conformance to UL 867-2007 including the ozone chamber testing and peak ozone test for electronic devices. Manufacturers that achieved UL 867 prior to December 21, 2007 and have not been tested in accordance with the newest UL 867 standard with the ozone amendment shall not be acceptable. All manufacturers requesting prior approval shall submit their independent UL 867 test data with ozone results to the engineer for preliminary review and during the submittal process. All manufacturers shall submit a copy with their quotation. Contractors shall not accept any proposal without the proper ozone testing documentation.

G. The maximum allowable ozone concentration per the UL 867-2007 chamber test shall be 0.001 PPM. The maximum peak ozone concentration per the UL 867-2007 peak test as measured 2 inches away from the electronic air cleaner’s output shall be no more than 0.001 PPM. Manufacturers with ozone output exceeding these ozone values shall not be acceptable.

H. All manufacturers shall have their product tested to UL 2998 Environmental Standard for confirmation of no ozone with certificate available. The final report shall indicate the ozone levels and high voltage output the device’s electrode(s) were operating during the test. Reports that do not include high voltage output during the UL 2998 testing shall not be acceptable.

1.5 SUBMITTALS

A. Submit shop drawings in accordance with Section 23 00 00.

B. Product Data: Submit manufacturer's technical product data for ion generators including:

1. Schedule of plasma generators indicating unit designation, number of each type required for each unit/application.
2. Data sheet for each type of plasma generator, and accessory furnished; indicating construction, sizes, and mounting details.
3. Performance data for each type of plasma device furnished.
4. Indoor Air Quality calculations using the formulas within ASHRAE Standard 62.1-2007 to validate acceptable indoor air quality at the quantity of outside air Scheduled (when projects are designed with outside air reduction).
5. Product drawings detailing all physical, electrical and control requirements.
6. Copy of UL 867 independent ozone test.
7. Copy of UL 2998 conformance certificate.
8. Statement on the manufacturer’s letterhead stating that the technology contains no titanium dioxide (Ti02).
9. Job-specific, factory wiring diagrams and instructions for field installation of all components.

1.6 SUBSTITUTIONS

A. The listed equivalent or substituted manufacturers along with the bidding related contractor shall be completely responsible to comply with all requirements on all contract documents. This shall include, but not limited to, space requirements, code clearances, the type, horsepower, capacities, number and size of services required from other trades, including all required ancillary items provided by other trades. If the manufacturer or related bidding contractor does not comply with these requirements, this Contractor shall be responsible for any and all additional costs associated with the changes required by other trades.

1.7 WARRANTY/GUARANTEE

A. All work and materials are subject to the general warranty as described in the General Conditions of the Contract and in Divisions 1, General Requirements.

PART 2 – PRODUCTS

2.1 AIR PURIFCATION SYSTEM

A. GENERAL: The air purification system(s) shall be of the size, type, arrangement and capacity indicated and required by the unit furnished and shall be of the manufacturer specified.

B. Each air handling unit, so designated on the drawings, details, equipment schedules and/or specifications shall contain a Plasma Generator with Bi-polar Ionization output as described herein.

C. The Bi-polar Ionization system shall be capable of:

1. Effectively killing microorganisms downstream of the bi-polar ionization equipment (mold, bacteria, virus, etc.).
2. Controlling gas phase contaminants generated from human occupants, building structure, furnishings and outside air contaminants.
3. Capable of reducing static space charges.
4. Effectively reducing space particle counts.
5. All manufacturers shall provide documentation by an independent NELEC accredited laboratory that proves the product has minimum kill rates for the following pathogens given the allotted time and in a space condition:
   a. MRSA - >96% in 30 minutes or less
   b. E.coli - > 99% in 15 minutes or less
   c. TB - > 69% in 60 minutes or less
   d. C. diff - >86% in 30 minutes or less
   e. Noro Virus -> 93.5% in 30 minutes or less
   f. Legionella -> 99.7% in 30 minutes or less

   Manufacturers not providing the equivalent space kill rates shall not be acceptable. All manufactures requesting prior approval shall provide to the engineer independent test data from a NELAC accredited independent lab confirming kill rates and time meeting the minimum requirements stated. Products tested only on Petri dishes to prove kill rates shall not be acceptable. Products being sold under different trade names than those tested shall not be acceptable.
6. Capable of modular field assembly in 6-inch sections.

D. The bi-polar ionization system shall operate in a manner such that equal amounts of positive and negative ions are produced. Uni-polar ion devices shall not be acceptable. Ionizers with positive

and negative output (DC type) shall not be acceptable. All ionizers provided shall be AC type ionizers with one electrode pulsing between positive and negative.

1. Air exchange rates may vary through the full operating range of a constant volume or VAV system. The quantity of air exchange shall not be increased due to requirements of the air purification system.
2. Velocity Profile: The air purification device shall not have maximum velocity profile.

E. Humidity: Plasma Generators shall not require preheat protection when the relative humidity of the entering air exceeds 85%. Relative humidity from 0 - 100%, condensing, shall not cause damage, deterioration or dangerous conditions within the air purification system. Air purification system shall be capable of wash down duty.

F. Equipment Requirements:

1. Electrode Specifications (Bi-polar Ionization):
   a. Each alternating current (AC) Ionization Bar with Bi-polar Ionization output shall include a minimum of eighteen carbon fiber cluster ion needles per foot of coil face width shall be provided. The entire cooling coil width shall have equal distribution of ionization across the face. Systems without ion needles at least 0.50” apart shall not be acceptable. The plasma electrode shall require no more than 1.0” in the direction of airflow for mounting. All hardware required for mounting shall be provided by the air purification manufacturer except self-tapping screws for the power supply. Bi-polar ionization tubes manufactured of glass and steel mesh shall not be acceptable due to replacement requirements, maintenance, and performance output reduction over time, ozone production and corrosion.
   b. Electrodes shall be provided in 6-inch increments, epoxy filled for an IP55 rating and utilizing brass connection hardware that is recessed into the connection joint once fully engaged and assembled.
   c. Electrodes shall be energized when the main unit disconnect is turned on.
   d. The ionization output shall be a minimum of 60 million ions/cc per inch of cooling coil width as measured 1 inch from the cold plasma needles.
   e. Ionization bars shall be provided with magnet mounting kits to prevent penetration into cooling coils.
   f. Ionization bars shall be constructed of UL 94VO and UL746C composite material.

G. Air Handler Mounted Units: Where so indicated on the plans and/or schedules. Mount the Plasma Generator and wire it to the remote mount power supply using the cables provided by the air purification manufacturer. A 24VAC, 115VAC or 208-230VAC circuit shall be provided to the plasma generator power supply panel. No more than 15 watts shall be required per power supply. Each power supply shall be capable of powering up to 6 ionization bars or a total of 100 linear feet of bar. Each plasma generator shall be designed with powder coated metal casing, liquid tight flexible conduit and a high voltage quick connector.

H. Plasma Requirements: Plasma Generators with Bi-polar ionization output shall be capable of controlling gas phase contaminants and shall be provided.

1. The Bi-polar ionization system shall consist of Bi-Polar Plasma Generator and power supply. The Bi-polar system shall be installed where indicated on the plans or specified to be installed. The device shall be capable of being powered by 24VAC, 115VAC or 208-230VAC without the use of an external transformer. Ionization systems requiring isolation transformers shall not be acceptable.

2. Ionization Output: The ionization output shall be controlled such that an equal number of positive and negative ions are produced (AC Ionizers only are acceptable). Imbalanced levels shall not be acceptable.
3. Ionization output from each bar shall be a minimum of 60 million ions/cc per inch of bar when tested at 1" from the ionization bar. Bars with needles spaced further apart than 0.5" shall not be acceptable.
4. Each plasma electrode shall be made from an all composite, UL 94V0 and UL 746C rated material for prevention of corrosion and electrical insulation.
5. Ozone Generation: The operation of the electrodes or Bi-polar ionization units shall conform to UL 2998 as tested by UL proving no ozone output.

I. Electrical Requirements:

1. Wiring, conduit and junction boxes shall be installed within housing plenums in accordance with NEC NFPA 70. Plasma Generator shall accept an electrical service of 24VAC or 115 VAC, 1 phase, 60 Hz. Coordinate all electrical requirements with air purification manufacturer's submittals.

J. Control Requirements:

1. All Plasma Generators shall have internal short circuit protection, overload protection, and automatic fault reset. Systems requiring fuses shall not be acceptable.
2. The Plasma Generator power supply shall have internal circuitry to sense the ionization output and provide dry contact alarm status to the BMS as well as a local "Plasma On" indication light.
3. The ionization system shall be provided with a stand-alone, independent ion sensor designed for plenum mounting to the ionization bar to monitor the ion output and report to the BAS system that the ion device is working properly. Ion systems provided without an independent ion sensor, shall not be permitted. The control voltage to power the ion sensor shall be 24VAC to 260VAC and draw no more than 150mA of current. The sensor shall provide at minimum, dry contact status to the BAS and optionally a BacNet or Lonworks interface as specified on the control drawings. Manufacturers not providing a stand-alone ion sensor shall not be acceptable.
4. Mount and wire the Plasma device within the air handling unit specified or as shown or the drawings. The contractor shall follow all manufacturer IOM instructions during installation.
5. A fiberglass NEMA 4X panel with Plasma On/Off Indicator Light (interfaced with stand-alone ionization detector), Ionization Output On/Off Indicator Light and an On/Off Illuminated Switch shall be provided to house the power supply, as noted on the schedule.

K. Manufacturers: Global Plasma Solutions, American Ion, Active Air Solutions, Bio Climatic.

1. Any listed equivalent manufacturer and the Mechanical Contractor shall be completely responsible to comply with all requirements on the contract documents. This shall include, but not be limited to, space requirements, code clearances, the type, horsepower, capacities, number and size of services required from other trades.

PART 3 – EXECUTION

3.1 GENERAL

A. The Contractor shall be responsible for maintaining all air systems until the owner accepts the building.

3.2 ASSEMBLY: PLASMA GENERATOR

A. All equipment shall be assembled and installed in a workmanlike manner to the satisfaction of the manufacturer’s authorized representative.

B. Any material damaged by handling, water or moisture shall be replaced, at no cost to the owner.

C. All equipment shall be protected from dust and damage on a daily basis throughout construction.

3.3 TESTING

A. Provide the manufacturers recommended electrical tests.

3.4 START-UP & TRAINING

A. A manufacturer's local authorized representative shall provide installation, start-up supervision, and training of owner's personnel in the proper operation and maintenance of all equipment.

END OF SECTION

SECTION 23 75 00

CUSTOM-PACKAGED OUTDOOR HVAC EQUIPMENT

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the contract, including the conditions of the contract (General, Supplementary and other Conditions, if any) and Division 1 as appropriate, apply to the work specified in this section.

B. Refer to Section 23 00 00 for HVAC General Provisions

C. Refer to Section 23 05 00 for HVAC Basic Materials & Methods.

1.2 DESCRIPTION OF WORK

A. This Section includes all work necessary and/or required and all materials and equipment for construction of a complete system. Such work includes, but is not limited to the following:

1. Heat Recovery Rooftop Unit (PoolPak Unit)

1.3 REFERENCE STANDARDS

A. Refer to Section 23 00 00 for a general description of requirements applying to this section.

B. Media type air filters shall comply with U.L. Standard 900.

1.4 QUALITY ASSURANCE

A. Refer to Section 23 05 00 for a general description of requirements applying to this section.

1.5 SUBMITTALS

A. Submit shop drawings in accordance with Section 23 00 00.

B. Submit shop drawings and descriptive date for all equipment specified in this section.

1.6 SUBSTITUTIONS

A. The listed equivalent or substituted manufacturers along with the bidding related contractor shall be completely responsible to comply with all requirements on all contract documents. This shall include, but not limited to, space requirements, code clearances, the type, horsepower, capacities, number and size of services required from other trades, including all required ancillary items provided by other trades. If the manufacturer or related bidding contractor does not comply with these requirements, this Contractor shall be responsible for any and all additional costs associated with the changes required by other trades.

1.7 WARRANTY/GUARANTEE

A. All work and materials are subject to the general warranty as described in the General Conditions of the Contract and in Division 1, General Requirements. In addition, the following special guarantee applies:

1. Each compressor unit shall be provided with manufacturer's five (5) year warranty.

PART 2 – PRODUCTS

2.1 HEAT RECOVERY ROOFTOP UNIT (POOLPAK UNIT)

A. GENERAL

1. Provide where indicated, factory assembled, enclosed swimming pool environmental control / energy recovery system. System shall include mechanical heat recovery, supply and return / exhaust fans, outdoor, exhaust and recirculated air dampers, pool water heater, moisture disposal and complete solid state logic control system, factory installed and wired in a single unit enclosure.

2. The complete unit shall be listed by Underwriter Laboratories under the title of "Special Purpose Air Conditioners" and carry the appropriate label. Underwriter Laboratories listing shall not be required for units equipped with electric, gas or steam auxiliary heat; but these units shall be built in accordance with Underwriter Laboratories requirements.
3. The unit shall be specifically designed, manufactured and tested for enclosed swimming pool duty. Field assembled or modified standard commercial grade equipment is not acceptable. Complete unit shall be weatherproofed for outdoor installation and also suitable for indoor mounting.
4. Manufacturer shall have five years prior experience making similar equipment as described in this specification.

B. Principle of Operation:

1. The unit shall control space temperature and relative humidity, pool water temperature and shall provide controlled ventilation. Warm moist air from the natatorium is drawn over an evaporator coil by the return fan; and the latent and sensible heat is removed from the air. The heat captured by this process and the heat generated from the compressor power consumption are absorbed by a mechanical refrigeration system. The resulting dryer, cooler air is blown into a mixing box. The unit shall include an automatic economizer control function in which the system logic determines what portion, if any, of the "leaving evaporator" air to exhaust from the mixing box and replace with an equal amount of outside air. The selected exhaust air quantity is that which will result in the least electrical power consumption by the unit, based upon a comparison of outside air temperature and humidity, return air temperature and humidity and "leaving evaporator" air temperature and humidity. The air from the mixing box is drawn over a condenser coil and optional auxiliary heating coil by a supply fan.
2. The refrigeration system is activated if either the space temperature deviates from or the relative humidity rises above its setpoint.
3. The unit shall monitor space and outdoor temperature and relative humidity, pool water temperature and building wall temperature.
4. The thermal energy absorbed by the refrigeration system is distributed as follows:
   (a) First priority is given to maintaining the natatorium space temperature. No supplementary space heating system external to the unit is required.
   (b) Second priority is given to maintaining pool water temperature.

C. Unit Casing:

1. All panel work and structural steel members shall be of galvanized steel, treated and painted after fabrication but prior to assembly to provide a chlorine and pool chemical resistant finish. The paint shall be plastic epoxy based powder coating, applied .003 inch (2-3 mils) thick, and baked and bonded at 420□F until it forms a hard vinyl textured surface.
2. Structural steel frame shall be 3/16 inch steel channel base with 3/16 inch steel cross bracing. Vertical support posts for removable panels shall be formed from 16 gauge galvanized steel and painted. All nuts, bolts and lock washers shall be Cadmium plated. All sheet metal screws shall be Empigard coated galvanized steel.
3. Top panels and removable side panels shall be formed from 18 gauge galvanized steel. Access panels shall be secured by two or more key operated latches. All side panels shall be insulated with minimum one inch duct liner insulation secured to panels by adhesive and panel flanges. The insulation shall be approved for 350□F operating temperature. The fire resistance rating shall conform to NFPA Standard 90A and 90B. The thermal conductivity shall not exceed 0.29 BTU/hr/F/sq. ft/in at 75□F. All seams shall be bolted and sealed to prevent leaks. The roof shall

be gasketed and secured to frame with Empigard coated zinc treated screws. All nuts, bolts and lock washers exposed to the natatorium air shall be Cadmium plated. All sheet metal screws exposed to the natatorium air shall be Empigard coated galvanized steel.

4. Compressors, pool water heat recovery unit, and controls, including solenoid and expansion valves and refrigerant sight glasses shall be located in compartments isolated from unit air stream.
5. The unit shall be equipped with two factory mounted terminal blocks, for dual power supply connections, one for the fan and control transformer circuit and one for compressor circuit. The terminal blocks shall be suitable for copper conductors only.
6. Heavy duty wire guards on condenser coil and fan discharge.

D. Compressor:

1. The dehumidifier shall utilize a heavy duty industrial semi-hermetic compressor(s) with a total of 3 stages serviceable type with suction gas cooled motor equipped with internal solid state sensor thermal protection, service valves, easily removable external crankcase heater for liquid migration protection, pumpdown cycle protection and oil failure protection.
2. Capacity control shall be electro-hydraulic, allowing reduced load starting and variable load operation. Capacity control through hot gas by-pass is absolutely not permissible. Forced feed lubrication system shall include self-priming, positive displacement, replaceable oil pump, oil strainer, sight glass and crankcase oil heater. The compressor shall use ring plate suction valves and "discus puck" type discharge valves, large diameter, high strength modular cast iron crank shaft.

E. Pool Water Heater:

1. Water heater shall be capable of rejecting all the heat recovered from the compressor and the heat recovered in the evaporator.
2. Pool water heater shall be counter flow, tube-in-tube type. Water side shall be Type L, cupro-nickel. Pool water heater shall be insulated with minimum 1/2 inch closed cell foam. If dehumidifier is located outdoors, pool water condenser shall be equipped with self-regulating electric heat tape for freeze protection.
3. Pool water condenser shall be a vented double wall with removable heads for inspection and cleaning.
4. Pool water heating is controlled by a refrigerant solenoid valve which directs hot refrigerant gas into the pool water heater on a call from the control system. Water circuit shall be applied with CPVC pipe stub-outs. Copper tubing and/or fittings in the pool water circuit shall be unacceptable.

F. Evaporator Coil:

1. Coil shall be constructed of copper tubes, .006 inch thick, copper fins with copper end sheets,frame and intermediate supports. All nuts, bolts and lock washers shall be cadmium plated. All sheet metal screws shall be Empigard coated galvanized steel. Coil construction of dissimilar metals such as copper / aluminum / galvanized steel / stainless steel or plastic / vinyl coated coils shall not be acceptable.
2. All tubes shall be expanded into fin collars. All joints shall be brazed. The coil shall be tested to 320 PSIG while submerged in water. All brazing shall be done with nitrogen gas inside tubes to give clean internal surfaces. The coil shall be dried and sealed. Its inside shall be commercially free of oxides and foreign matter. Coil assembly shall be 1600 PSIG ultimate strength.
3. The coil shall be sectioned to provide proportional air-to-refrigerant latent and sensible heat removal capacity. This capacity modulation shall be accomplished by utilizing multiple thermal

expansion valves (TXV) for the evaporator. Each TXV shall be equipped with a refrigerant flow control solenoid valve and refrigerant sight glass.

G. Condenser Coil:

1. Condenser coil shall be capable of rejecting all the heat recovered from the compressor and the heat recovered in the evaporator.
2. The condenser coil shall be constructed of copper tubes, .006 inch thick, copper fins with copperend sheets, frame and intermediate supports. Coil construction of dissimilar metals such as copper / aluminum / galvanized steel / stainless steel or plastic / vinyl coated coils shall not be acceptable.
3. All nuts, bolts and lock washers shall be Cadmium plated. All sheet metal screws shall be Empigard coated galvanized steel.
4. All tubes shall be expanded into fin collars. All joints shall be brazed. The coil shall be tested to 400 PSIG while submerged in water. All brazing shall be done with nitrogen gas inside tubes to give clean internal surfaces. The coil shall be dried and sealed. Its inside shall be commercially free of oxides and foreign matter. Coil assembly shall be 2000 PSIG ultimate strength.

H. Auxiliary Air Heating: The auxiliary air heating shall be provided by two factory mounted, and wired indirect gas fired furnaces. Field installed duct furnaces shall not be acceptable. Unit mounted gas furnaces shall be constructed with 409 stainless steel primary and secondary heat exchangers, spark-ignited intermittent safety pilot with electronic flame supervision, two stage controls, fan control, high limit safety cutout.

I. Air Filters: The evaporator and condenser coil shall each be protected with a separate upstream air filter system. The filters shall be 2 inch thick, multigraduated, laminated polyester construction, throwaway type. The filters shall have a non-migrating tackifier encapsulated between the second and third laminates. They shall be totally non-toxic, non-allergenic and not support the growth of bacteria and fungus.

J. Mixing Box: The mixing box shall be integral to the unit and physically located between the evaporator and condenser coils. The mixing box shall be equipped with three dampers to control the amount of exhaust, outside and recirculated air. The exhaust damper shall be downstream of the evaporator coil to allow full heat reclaim prior to exhaust of the air. The air condenser coil shall be located downstream of the outside air intake to allow utilization of outside air when available or necessary.

K. Louvers:

1. If the dehumidifier is located outdoors, the dehumidifier shall be equipped with a louver and bird screen for both the outside air and exhaust air dampers.
2. The louvers shall be constructed so as not to reduce the face area of the dampers. The louver and bird screen construction and paint shall be the same as for the dehumidifier casing. The louver and bird screen shall be factory installed.

L. Dampers: Air mixing compartment shall be provided with opposed blade, less than 1% leakage, neoprene tipped, anodized aluminum air foil cross section dampers. Each damper section shall be operated by a separate motor factory mounted and wired into unit control panel; and be capable of modulating the dampers from 0% to 100%.

M. Supply Fan and Return Fan: The units shall be factory equipped with a supply fan and a return fan. These fans shall be multi V-belt driven, double inlet centrifugal type with multiblade forward curved wheels. Construction shall be galvanized steel, painted and baked with an epoxy coating providing a chlorine and pool chemistry resistant finish. The fans shall be dynamically and statically balanced and tested on the shafts. Fan bearings shall be grease lubricated, self-aligning ball bearings selected for

200,000 hours average life.

N. Fan Motors: Fan motors shall be induction type, totally enclosed fan cooled with Class F insulation, prelubricated ball bearings and shall be mounted on an adjustable base. Motor to be U.L. listed. Supply and return fan motors shall each be provided with individual factory mounted and wired motor starters.

O. Drain Pan:

1. The floor of each air side section shall be fabricated to be a drain pan. Each drain pan shall be constructed of galvanized steel and powder coat painted after fabrication with a protective coating providing a chlorine and pool chemistry resistant finish. Drain pans shall be fully insulated and piped to a common drain accessible from either side of the unit.
2. If the unit is located outdoors all drain lines within the unit shall be insulated with minimum 3/4 inch closed cell foam with self-regulating electric heat tape for freeze protection.

P. Refrigeration Circuit: The refrigeration system shall include a replaceable core liquid line filter dryer, liquid receiver, thermostatic expansion valves, pumpdown solenoid valves, two manual valves to isolate filter drier for fast drier core replacement and manual valves to isolate the liquid receiver. Suction lines shall be fully insulated with closed cell foam insulation. High and low pressure controls and refrigeration service access valves shall be located outside of the air stream. All refrigerant piping shall be copper Type L and is in accordance with "BOCA STANDARDS" ASTM B 88 for Copper Tubing, and M-702.0 for Joints and Connections.

Q. Control Panel:

1. The controller shall be micro computer based, The following functions / setpoints shall be programmable at the panel:
   a. Air Temperature
   b. Relative Humidity
   c. Pool Water Temperature
   d. Occupied / Unoccupied Schedule
   e. Damper Positions
2. The following LCD readouts and / or annunciation lights shall be provided:
   a. Power On
   b. Space Temperature
   c. Space Relative Humidity
   d. Pool Water Temperature
   e. Pool Water Flow
   f. Wall Condensation Prevention Temperature
   g. Outside Air Temperature
   h. Outside Air Relative Humidity
   i. Supply Air Temperature
   j. Damper Position
   k. Compressor(s) Circuit Fault
   l. Compressor(s) in Pumpdown
   m. First Stage of Compressor(s) On
   n. Second Stage of Compressor(s) On

o. Third Stage of Compressor(s) On

p. Unit in Air Heating Mode

q. Unit in Dehumidifying Mode

r. Auxiliary Air Heating Coil On

s. Pool Water Heating On

t. Time of Day / Day of Week

3. Control panel shall be integral to the unit and located in a separate compartment isolated from air flow. Compressors shall be equipped with contactors. Blower motors shall be equipped with motor starters and protected with adjustable magnetic trip overloads. Dry contacts shall be provided for alarm and fan interlock. Power block terminals shall be provided for different wire size connections. Wire shall be numbered and color coded for ease of trouble-shooting. Compressor shall have an anti-recycle timer to prevent short cycling.

4. The memory of the micro-computer control panel shall have a fault code history log. This fault code history log shall record the last 50 fault codes in the order of their occurrence. Each fault code shall be recorded along with the date and time it occurred. This fault code history log shall be accessible at the control panel, and, for so equipped units, at the remote panel and/or via modem and phone lines.

5. The dehumidifier control panel shall be capable of being remotely accessed via modem.

6. All wiring and electrical controls shall be done and installed in accordance with BOCA STANDARD M407.1.

7. The controls shall continuously monitor the 3-phase power lines for abnormal conditions and detect phase loss even when regenerated voltage is present. The device consists of a solid-state voltage and phase-angle sensing circuit driving an electromechanical relay. When correct voltage and phase rotation are applied, the internal relay will energize. A fault condition shall de-energize the relay; when the fault is corrected the device shall automatically reset.

8. Remote Control Panel: The dehumidifier shall be remotely monitored and controlled. All setpoints and monitoring functions listed in **CONTROL PANEL section** shall be capable of being remotely controlled and monitored from the remote terminal and simultaneously at the dehumidifier control panel. Remote monitoring and controlling shall be accomplished by a remote CRT with keyboard (provided by the dehumidifier manufacturer) and via an auto-answer, 1200 BAUD modem (by dehumidifier manufacturer) and an electronic data transmission quality telephone line located at the remote terminal location (by owner). The remote terminal will be linked to the dehumidifier control system by a shielded 2 wire cable (18 gauge) standard copper up to 2000 feet (by dehumidifier manufacturer).

R. Control Sensors:

1. The unit shall be provided with the following factory mounted and wired control sensors:

a. Space Dry Bulb Temperature

b. Space Relative Humidity

c. Air-Leaving-Evaporator Dry Bulb Temperature

d. Air-Leaving-Evaporator Relative Humidity

e. Pool Water Temperature

f. Supply Air Dry Bulb Temperature

2. The unit shall be delivered with the following factory supplied sensors to be installed in the field by the unit manufacturer:

a. Outside Air Dry Bulb Temperature

b. Outside Air Relative Humidity

c. Natatorium Wall Condensation Prevention Temperature Sensor

S. Environmental Logic Controls:

1. All operating and logic controls shall be factory mounted and wired in the unit. Control sequences shall be designed specifically to control swimming pool environmental conditions by the unit manufacturers.
2. At a minimum, control system shall provide full modulation of heat recovery / heating system by proportional control of dry bulb temperature, relative humidity, cold-wall surface condensation prevention humidity reset and ventilation air volume.
3. Controls shall automatically operate heating, dehumidification and heat recovery system in response to greatest requirement and adjust unit outputs to maintain building conditions. Unit and controls shall be capable of providing full heating capacity to either air or water. Controls shall be capable of proportional control of heating and dehumidification by loading stages of compressor capacity as necessary. As building requirements are satisfied, unit shall unload and shut off. At a minimum, unit shall provide the following functions:

   a. Economizer/Ventilation: Providing outdoor air ventilation as a function of indoor and outdoor conditions. The economizer shall operate in either the space heating, space cooling, space heating and dehumidification or space cooling and dehumidification mode.

   b. Occupied / Unoccupied Control Mode: Time clock for 7-day, 24-hour operation controlling the unoccupied mode operation during heating season. During unoccupied times the outside air and exhaust dampers stay in closed position to minimize the air heating load.

   c. Space Heating: Full proportional control of space dry bulb temperature by staging compressor loading of unit capacity, with humidity override. Automatic mechanical heat recovery from pool room return air as required by building and / or water temperature. Return / exhaust air must pass through mechanical heat recovery system and shall be exhausted at its lowest heat content. Automatic switching and three (3) stage outputs for control of auxiliary air heating coil shall be performed.

Condition	**Action**
At Setpoint	Ventilation
At a drop from setpoint	Economizer if outdoor temperature is higher than return air.
At further drop from setpoint	Valve directing hot gas to air condenser energized. First and successive stages of compressor energized. Smart Economizer

Auxiliary air heating shall be controlled in two (2) stages as follows:

1st stage: energize gas furnace(s) on low fire

2nd stage: energize gas furnace(s) on high fire

d. Smart Economizer: The Smart Economizer is the simultaneous operation of the Heat Recovery Heating and Economizer modes.

Condition	Action
Natatorium requires dehumidification and/or heating and the outside air dry bulb and dew point are warmer and dryer, respectively, than the air off the evaporator coil	100% of the air from the evaporator is exhausted. 100% warm dry air is drawn into the PoolPak with its supply fan. The warm dry outside air is heated further as it passes over the condenser coil and supplied to the natatorium.

e. Pool Water Heating: If the space temperature is at or above setpoint and the pool water temperature is below the setpoint, hot gas is directed to the pool water condenser when the compressor is running. At other times the pool water requires heat, the PoolPak activates the main pool water heater.

f. Humidity Control The economizer is activated if dehumidification is required and:

(1) the air and water temperatures are satisfied, and

(2) the absolute humidity of the outside air is lower than the absolute humidity of the pool room air, and

(3) the outside air temperature will not adversely effect the pool room air temperature.

If outside air cannot be used for dehumidification, then full proportional control of relative humidity is done by staging unit capacity. Humidity controller energizes the compressor and directs hot gas to the air condenser if space needs heating or water condenser if pool water temperature is below setpoint.

If dehumidification is required and the air and water temperatures are satisfied and the outside air cannot be used to dehumidify the pool room and Flywheel Air Conditioning is not enabled, then the hot gas is directed to the external air cooled condenser, chilled water or cooling tower condenser or the auxiliary chilled water coil is activated, if so equipped.

Condition	Action
At Setpoint	Ventilation
At a rise from setpoint	Economizer if outdoor dew point is lower than return air dew point.
At further rise from setpoint	Valve directing hot gas to air condenser, pool condenser or ext. air-cooled condenser energized. First and successive stages of compressor energized. Smart Economizer

g. Condensate On Walls: When the temperature of the interior surface at the wall sensor drops to within 5°F of the dew point temperature of the space air, the relative humidity setpoint is offset downward. This condition causes the dehumidifier system to activate humidity control lowering the space dew point and hinders the formation of condensation on the cold wall surfaces.

h. Air Conditioning: Flywheel Air Conditioning

(1) This air conditioning control strategy uses the thermal storage capacity of the swimming pool. During occupied times the PoolPak cools the Natatorium air by removing the sensible and latent heat from the air in the evaporator. This heat is put into the pool water. The pool water's temperature is allowed to rise a maximum of 2°F above its normal setpoint. Automatic staging of cooling capacity is in response to air conditioning load.

(2) During the unoccupied time, if the pool water is above its setpoint, full ventilation is used to evaporatively cool the pool. This mode of operation continues until either the pool water goes 1° F below its setpoint or an occupied period starts.

(3) The changeover from heating to air conditioning as a function of dry bulb cooling demand in the Natatorium is automatic. A normal changeover deadband of 1.5°F between heating and cooling is used.

(4) This cycle is repeated as long as the requirement to provide air conditioning during the occupied periods exists.

T. Operating and Safety Controls:

1. Each unit shall be provided with a complete operating and safety logic control system. The control system shall shut down the compressor in case of high refrigerant pressure, low refrigerant pressure, oil failure, and / or high motor temperature conditions. The complete unit (fans & compressor) shall be shut down to protect the motors if power line abnormalities occur.

2. Operating and safety control system shall include all relays, contactors, sensors and switches necessary to operate complete unit.

U. Manufacturer:

1. Unit shall be base bid with specified PoolPak, Inc. - PoolPak SWHP 100. Moisture removal rate shall be a minimum of 117 pound/hr.

V. Installation:

1. Comply with manufacturer's printed instructions except where more stringent requirements are shown or specified, and except where manufacturer's technical representative directs otherwise.

2. Install unit where shown on drawings. Provide three feet clearance around sides and four feet around compressor compartment of unit for air flow and service.

3. Provide and install all water piping, drains and controls for proper operation of unit.

W. Start-Up:

1. Start-up service shall be provided by the equipment manufacturer's authorized representative and shall include complete testing of all controls and unit operation. The agency responsible for start-up shall record the refrigeration pressures and electrical operating data. Copies of this data are to be supplied to the owner.

2. All units shall be thoroughly cleaned by the installing contractor in accordance with the manufacturer's instructions prior to being placed into service.

3. A complete operating and maintenance manual, including wiring diagrams, start-up and operating sequence and material list shall be provided to the owner.

4. The owner shall be provided with complete instruction of operating and maintenance procedures.

X. Warranty:

1. One year parts and material and labor warranty on the entire unit.
2. Drive Line Warranty - A four year extended parts warranty shall be provided on the:
   a. Compressors
   b. Compressor Motor Contactors
   c. Return Fan Motor
   d. Return Fan Motor Starters
   e. Supply Fan Motor
   f. Supply Fan Motor Starters
   g. Pool Water Condenser
   h. Pool Water Condenser Solenoid Valves & Coils
   i. Liquid Expansion Solenoid Valves & Coils
   j. Air Condenser Solenoid Valves & Coils
   k. Blowers, Wheels & Housings
3. A nine year extended parts warranty shall be provided on the all-copper evaporator, condenser and auxiliary hot water heating coils.
4. These warranties are contingent on proper maintenance of pool water chemistry including a pH of between 7.2 to 7.6, Free Chlorine not exceeding 2.0 ppm and Combined Chlorine not to exceed 0.5 ppm. These parameters are to be measured and recorded daily and be available for review upon request.
5. AutoGuard Service - For units equipped with a modem and phone line, the manufacturer shall call the unit once a week for the first two years and down load the fault code history log as well as review the performance and status of the unit. If a problem is detected, the manufacturer's service department shall call the owner's representative to further diagnose and solve the problem.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Verify that coils, filters, motors, drives and other components are matched with the proper unit.

B. Assemble unit components following manufacturer's instructions for handling, testing and operating. Repair damaged galvanized areas, and paint in accordance with manufacturer's written recommendations.

C. Vacuum clean interior of units prior to operation.

D. Repair air leaks from or into casing that can be heard or felt during normal operation.

E. Perform field mechanical balancing in accordance with Section 23 05 93.

F. The Mechanical Contractor shall own as a part of his work, the following:

Provide one (1) additional drive set, if necessary, to obtain final design balancing requirements. The Mechanical Contractor shall coordinate with Balancing Firm and equipment manufacturer for drive selection, including belts and pulleys.

END OF SECTION

SECTION 23 83 00
RADIANT HEATING UNITS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the contract, including the conditions of the contract (General, Supplementary and other Conditions, if any) and Division 1 as appropriate, apply to the work specified in this section.

B. Refer to Section 23 00 00 for HVAC General Provisions

C. Refer to Section 23 05 00 for HVAC Basic Materials & Methods.

1.2 DESCRIPTION OF WORK

A. This Section includes work necessary and/or required and materials and equipment for construction of a complete system. Such work includes, but is not limited to the following:

1. Electric Unit Heaters
2. Electric Radiant Heating Panel
3. Electric Cabinet Heaters
4. Electric Wall Heaters

1.3 REFERENCE STANDARDS

A. Refer to Section 23 00 00 for a general description of requirements applying to this section.

1.4 QUALITY ASSURANCE

A. Refer to Section 23 05 00 for a general description of requirements applying to this Section.

1.5 SUBMITTALS

A. Submit shop drawings in accordance with Section 23 00 00.

B. Submit shop drawings and descriptive date for all equipment specified in this section.

1.6 SUBSTITUTIONS

A. The listed equivalent or substituted manufacturers along with the bidding related contractor shall be completely responsible to comply with all requirements on all contract documents. This shall include, but not limited to, space requirements, code clearances, the type, horsepower, capacities, number and size of services required from other trades, including all required ancillary items furnished and installed by other trades. If the manufacturer or related bidding contractor does not comply with these requirements, this Contractor shall be responsible for any and all additional costs associated with the changes required by other trades.

1.7 WARRANTY/GUARANTEE

A. All work and materials are subject to the general warranty as described in the General Conditions of the Contract and in Division 1, General Requirements.

PART 2 – PRODUCTS

2.1 ELECTRIC UNIT HEATERS

A. Horizontal Unit: Construct casing of steel, phosphatized inside and out, and finished with baked enamel. Provide motor-mounted panel, minimum of 18 gauge steel. Fabricate casing to enclose heater, louvers and fan blades. Provide individually adjustable louvers for air diffusion.

B. Construct fans of aluminum and factory balance.

C. Metal sheath fin tube electric heating element.

D. Provide totally enclosed motors, with built-in overload protection, having electrical characteristics as scheduled.

E. Provide integral residual heat sensor to continue fan operation until element temperature fall below preset point.

F. Manufacturers: American Air Filter, Electromode,Trane, Berko, Indeeco, TPI/Markel, Q-Mark.

2.2 ELECTRIC RADIANT HEATING PANEL

A. Provide radiant heating panels scheduled on the drawing. U.L. Listed. T-Bar Grip Clip to secure panel into grid ceiling.

B. Panel shall be constructed as follows:

Front - 24-gauge galvanized steel.

Back - 24-gauge galvanized steel.

Sides - Shall be overlapping front and back, riveted together.

C. Wire - internal 200 degree C, 14 gauge, Teflon insulated. External - pigtails with 40" of 3/8" flexible, seal-tight conduit and connector for junction box.

D. Element - graphite based, uniform temperature distribution over entire panel surface.

E. Insulation - 1-1/4" thick, 4.2 pound density, high temperature fiberglass.

F. Surface - heat modules textured with ceiling white flame resistant finish. Suitable for high-humidity areas, with factory silicone seal.

G. Manufacturers: Solid State Heating Corp., Q-Mark, Aztec, TPI/Markel.

2.3 ELECTRIC CABINET HEATERS

A. Provide cabinet heaters including chassis, heating elements, fan and motor designed for either recessed mounting within 2’x2’ ceiling grid, or within wall construction.

B. Chassis: Galvanized steel wraparound structural frame with edges flanged.

C. Power disconnect switch, 30 AMPs, 600 volts, 3 phase.

D. Cabinet: Horizontal recessed model, heavy gauge, four sided overlap front panel with stamped steel louver air openings. Clean cabinet parts, phosphatize and coat with baked-on enamel finish. Color: white.

E. Coils: Steel fins, copper brazed, for a permanent bond to low watt density, steel sheathed tubular heating elements.

F. Grilles: Intake and outlet grilles shall be integral, stamped 15 deg. Deflection in ceiling trim ring.

G. Fans: Provide direct drive, five bladed aluminum.

H. Motors: Provide single speed impedance protected, totally enclosed motor with integral overload protection and motor cords to junction box in unit.

I. Provide built-in fan delay control and automatic thermal cutout.

J. Manufacturers: Q-Mark, Berko, TPI/Markel, Indeeco, Electromode.

2.4 ELECTRIC WALL HEATERS

A. Construct casing of steel, phosphatized inside and out, and finished with baked enamel. Provide motor-mounted panel, minimum of 18 gauge steel, fabricate casing to enclose heater, and fan. Front panel shall be tamperproof style with stamped louver grille. Suitable for recessed or surface mounting.

B. Construct fans of aluminum and factory balance.

C. Metal sheath fin tube electric heating element.

D. Provide totally enclosed motors, with built-in overload protection, having electrical characteristics as scheduled.

E. Provide integral residual heat sensor to continue fan operation until element temperature falls below preset point. Provide unit-mounted thermostat and disconnect.

F. Manufacturers: Q-Mark, Berko, TPI/Markel, Indeeco, Electromode.

PART 3 – EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which equipment is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION OF UNIT HEATERS

A. Install heaters in accordance with manufacturer's installation instructions.

B. Uncrate units and inspect for damage. Verify that nameplate data corresponds with unit designation.

C. Hang unit from building substrate.

D. Protect units with protective covers during balance of construction.

3.3 INSTALLATION OF CABINET HEATERS

A. Install cabinet heaters in accordance with manufacturer's installation instructions.

B. Locate cabinet heaters as shown on the drawings. Coordinate with other trades.

C. Protect units with protective covers during balance of construction.

3.4 INSTALLATION OF ELECTRIC HEATERS

A. Install heaters in accordance with manufacturer's installation instructions.

B. Uncrate units and inspect for damage. Verify that nameplate data corresponds with unit designation.

C. Hang unit from building substrate.

D. Protect units with protective covers during balance of construction.

E. Perform field mechanical balancing in accordance with Section 23 05 93.

END OF SECTION

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SECTION 26 00 00
ELECTRICAL

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including the Conditions of the Contract (General, Supplementary and other conditions, if any) and Division 1 as appropriate, apply to the work of this Section.

B. The specification or drawing and the design features or resulting construction disclosed, are the property of Furlow Associates, Inc., and shall not be reproduced without written permission.

1.2 DESCRIPTION OF WORK

A. Provide all materials, equipment, labor, services and all appurtenances required to completely install and satisfactorily operate the various systems. The items listed below are for general guidance only and do not necessarily include the entire requirements for the project.

1. Coordination with other trades
2. Interior feeders
3. Lighting and power panels
4. Lighting branch wiring
5. Power wiring
6. Lighting fixtures and lamps
7. Wiring devices
8. Connections for electrically operated equipment
9. Fire alarm and detection system
10. Telephone/Data system
11. Lightning protection system
12. Related work as herein described or otherwise defined under the heading "Related Work".

B. Wherever the term "provide" is used, it shall be understood to mean both "furnish" and "install".

1.3 RELATED WORK

A. Equipment specified in sections of Divisions 1 thru 28 that require electric power supply.

B. Work related to this trade as defined on the following contract drawings:

Architectural/Structural

HVAC

Plumbing

1.4 SITE CONDITIONS

A. Attention of all bidders is called to the necessity for a careful inspection of the site, its present condition and encumbrances, the extent of the work, the protection to be afforded to adjacent properties or structure, availability of utilities, the extent and nature of the material required to be excavated and the amount of fill and removal. He shall also determine local or site limitations which will affect construction.

1.5 PERMITS, INSPECTIONS AND ORDINANCES

A. All work shall be executed and inspected in accordance with local and state ordinances, rules and

regulations and the requirements of public utilities having jurisdiction. The contractor shall secure and pay for all permits, inspections and connections required.

B. The Electrical Contractor shall furnish a certificate of inspection to the Owner at the time of completion.

C. Requirements of the following organization shall be considered minimum:

1. National Electrical Code
2. National Electrical Safety Code
3. OSHA
4. Local City and County Codes

D. Reference to technical societies, trade organizations and governmental agencies are in accordance with the following:

1. ANSI - American National Standards Institute
2. ASTM - American Society for Testing Materials
3. IEEE - Institute of Electrical and Electronics Engineers, Inc.
4. NEC - National Electrical Code
5. NEMA - National Electrical Manufacturer's Association
6. NFPA - National Fire Protection Association
7. MSS - Manufacturer's Standardization Society
8. IES - Illuminating Engineers Society
9. ETL - Engineering Testing Laboratories
10. EIA - Electronic Industries Association
11. OSHA - Occupational Safety and Health Administration
12. Federal Specifications
13. UL - Underwriters Laboratories, Inc.

1.6 QUALITY ASSURANCE

A. Provide adequate supervision of labor force to assure that all aspects of the contract documents are fulfilled.

B. Contractor to provide manufacturer’s written certification that the following equipment has been installed and will operate correctly and in accordance with the manufacturer’s warranty requirements.

Fire Alarm and Detection System

C. Testing:

1. After completion of the work, the entire wiring system shall test entirely free from grounds, short circuits, opens, overloads and improper voltage.
2. The grounding system shall be tested for a resistance of 25 ohms or less.
3. Perform testing as follows: Arrange and pay for all tests, provide all equipment, materials and labor to perform test. Notify Engineer and Owner three (3) working days before tests are to be made. Conduct tests in the presence of the Engineer or authorized representative. Repeat tests after defects are corrected.

D. Special Engineering Services: In the instance of complex specialized electrical power and signaling systems, and other similar systems, the installation and final connections of these systems shall be made by and/or under the supervision of a competent installation and service engineer who shall be a

representative of the respective equipment manufacturer. Any and all expenses of these installation and service engineers shall be borne by this Contractor.

1.7 COORDINATION

A. As a requirement of this project, the Electrical Contractor shall furnish coordination for his equipment and layouts with other subcontractors furnishing equipment and services for Divisions 1 thru 23. Any and all contractors who install their equipment or furnish services prior to coordination, any contractor who changes their equipment or services after coordination has occurred, without notifying associated subcontractors, shall be held responsible for making all required changes with no additional cost to the Owner. Or delay in construction time. This coordination will include conduit layout to allow access to equipment for maintenance.

B. The Mechanical, Plumbing and Electrical Contractors are responsible to coordinate all manufacturer's recommended circuit breakers, starters, disconnects and fuse sizes for all equipment. Submission of a shop drawing will certify that this has been completed.

C. The drawings and specifications reflect the type, number and size of services required for the equipment the design is based upon. Should the supplying subcontractor elect to furnish an alternate piece of equipment requiring difference services and/or space conditions, he shall inform the subcontractor furnishing those services and be held responsible to pay for all required changes as part of this contract.

1.8 SUBMITTALS

A. Shop Drawings:

1. Shop drawings shall be submitted in accordance with Division 1 of these specifications except where herein modified.

NOTE: Submittals will only be reviewed once and resubmittals will be reviewed once. Any other submittals will be billed to the Contractor at the Engineer's standard rates.

2. Shop drawings comprising complete catalog cuts, performance test data for electrical equipment as required by other sections of Division 26 shall be submitted for review checking. The Contractor shall review these shop drawings for conformance to contract documents prior to submission and affix contractor's signature to each submittal certifying that this review has been done. By approving and submitting shop drawings, product data, wiring diagrams and similar materials, the Electrical Contractor represents that he and/or his subcontractor has determined and verified materials, field measurements and field construction data that relates to the work, and has checked and coordinated this information with all of the Divisions 1 thru 23 subcontractors.

3. All shop drawing submittals shall have the following identification data, as applicable, contained therein or permanently adhered thereto:

   a. Project name

   b. Project number

   c. Sub-Contractor's, Vendor's and/or manufacturer's name and address.

   d. Product identification.

   e. Identification of deviation from the contract documents.

   f. Applicable contract drawings and specification section number.

   g. Shop drawing title, drawing number, revision number, and date of drawing and revision.

   h. Resubmit revised or additional shop drawings as requested.

   i. Wherever shop drawings or vendor's standard data sheets indicate work to be done "by others", it shall be the responsibility of the Contractor making the submission to identify by

name, the Contractor who is to do this work. If the Contractor named is other than the Contractor making the submission, the shop drawing submission must be reviewed by the named Contractor and bear his mark of approval, prior to submission to the Architect/Engineer.

j. Where equipment proposed differs from that shown on the drawings or specified, he shall submit for approval drawings showing the manner in which the layout is affected by the substitution.

k. The Contractor shall keep one copy of approved shop drawings at the job site, filed in a suitable metal container. The shop drawings shall be cataloged and kept in good repair, and shall be available for use by the Owner, Architect and Engineer.

l. No equipment shall be ordered, fabricated, etc., before approval of shop drawings.

1.9 SUBSTITUTIONS

A. Whenever a material, article, piece of equipment or system is identified in the following specification or indicated on the drawings by reference to manufacturers' or vendors' names, trade names, catalog numbers or the like, it is so identified for the purpose of establishing the basis of the Bid.

B. Substitution approval must be obtained and included as an addendum item prior to the submission of the bid. An approved substitution shall not be considered as an approval for the contractor or an equipment vendor to deviate from the written portion of the specifications unless so stated in the addendum.

C. The drawings illustrate the space allocated for equipment and the Contractor shall install the equipment accordingly. If changes are required in the building or arrangement due to substitution of equipment, the Contractor making the substitution must pay for the necessary modifications.

D. The listed equivalent or substituted manufacturers along with the bidding related contractor shall be completely responsible to comply with all requirements on all contract documents. This shall include, but shall not be limited to space requirements, code clearances, the type, horsepower, capacities, number and size of services required from other trades, including all required ancillary items furnished and installed by other trades. If the manufacturer or related bidding contractor does not comply with these requirements, then they shall be responsible for any and all additional costs associated with the changes required by other trades.

1.10 LUBRICATION

A. Furnish, install and maintain all required lubrication of any equipment operated prior to acceptance by the Owner. Lubrication shall be as recommended by the equipment manufacturer.

B. Provide one year's supply of lubricants to Owner at date of acceptance.

C. Verify that required lubrication has taken place prior to any equipment start-up.

1.11 ADJUSTMENT & CLEANING

A. Adjust and clean equipment to be placed in proper operation condition.

1.12 EQUIPMENT START-UP

A. Verify proper installation by manufacturer or his representative.

B. Advise General Contractor 2 days prior to actual start-up.

C. Verify proper operation. Obtain signed statement by manufacturer or his representative that equipment is operating within warranty requirements. Submit statement to General Contractor.

1.13 OPERATION AND MAINTENANCE INSTRUCTIONS

A. Properly and fully instruct Owner's personnel in the operation and maintenance of all systems and equipment.

B. Insure that the Owner's personnel are familiar with all operations to carry on required activities.

C. Such instruction shall be for each item of equipment and each system as a whole.

D. Provide report that instruction has taken place. Include in the report the equipment and/or systems instructed, date, contractor, Owner's personnel, vendor, and that a complete operating and maintenance manual has been reviewed.

E. Manual shall include all instructions on operation, maintenance, repair parts list, lubrication requirements, brochures, catalogue cuts, wiring diagrams, piping diagrams, control sequences, service requirements, names and addresses of vendors, suppliers and emergency contacts. Three manuals shall be provided.

F. Submit manuals for review prior to operating instruction period. Manuals shall be 8-1/2 x 11" with hard cover, suitably bound.

G. Training

1. Electrical Contractor shall be responsible for coordination of Owner training. Factory employed technician(s) shall provide training, including demonstration and education on the system capabilities, operation and maintenance. Training sessions shall be minimum 4 hours (maximum 8 hours), and shall be provided for each shift of workers. Scheduled training shall be coordinated at least two 92) weeks in advance with the Owner and the Commissioning Agent.

2. Video Documentation: Furnish three (3) copies of a professionally taped video and three (3) copies of professionally prepared drawings demonstrating the following:

- Security System
- Fire Alarm System
- Integrated Access Control
- Clock and Speaker System
- VFD’s
- MDF/IDF
- Stage Sound System (Alternate)
- Stage Dimming Rack (Alternate)

1.14 TOOLS

A. All equipment furnished by the Contractor which requires special tools or devices other than those normally available to the maintenance or operating staff shall be furnished in duplicate to the Owner, sufficiently marked, packed or boxed for staff usage. The tools provided shall be listed by the Contractor identified as to their use or the equipment applicable in a written transmittal to the Owner.

1.15 CLEANING AND FINISHING

A. After equipment start-up and all operating tests have been made and the system pronounced satisfactory, each respective Contractor shall go over the entire project, clean all equipment, etc., installed by him and leave in a clean and working condition. Any surfaces found marred after this final cleaning shall be refinished or replaced by each Contractor at no cost to the Owner.

1.16 OPERATING AND MAINTENANCE MANUALS

A. Three complete sets of instructions containing the manufacturer's operating and maintenance instructions for each piece of equipment shall be furnished to the Architect. Each set shall be furnished before the contract is completed. The following identification shall be inscribed on the covers: the words "OPERATING AND MAINTENANCE INSTRUCTIONS", the name and location of the building, the name of the Contractor and the name of the Architect and Engineer. Flysheet shall

be placed before instructions covering each subject. The instruction sheets shall be approximately 8-1/2 by 11 inches, with large sheets of drawings folded in. The instructions shall include, but shall not be limited to, the following:

Approved wiring and control diagrams, with data to explain the detailed operation and control of each component.

A control sequence describing start-up, operation and shutdown.

Operating and maintenance instructions for each piece of equipment, including lubrication instructions.

Manufacturer's bulletins, cuts and descriptive data.

Parts lists and recommended spare parts.

1.17 SERVICE INTERRUPTION

A. All service interruptions to the electric or related systems, whether during regular working hours or at any other time, must be coordinated with the Owner. All such interruptions shall be so scheduled and planned as to require a minimum of time and shall occur only during a mutually satisfactory period.

1.18 INTERPRETATION OF SYSTEMS

A. The interpretation of the Architect will be final in the event there is a lack of understanding of the full scope or requirements of the systems under this contract.

1.19 LAYOUTS

A. On small scale drawings, i.e., 1/8" - 1'-0", the approximate location of the electrical branch circuit items such as receptacle, telephone, grounding and equipment outlets are shown to indicate their existence. The exact location of these items and their related raceways are governed by structural conditions, coordination with the work of other trades and the Architect's final decision. By accepting a contract, the Contractor agrees to install the work in accordance with the above statement and within the contract price.

PART 2 – PRODUCTS

2.1 MATERIAL

A. All material shall be new and of good quality. Material shall conform to all accepted trade standards, codes, ordinances, regulations, or requirements governing same, and shall be approved before being installed.

B. The Architect reserves the right to require the Contractors to submit samples of any or all articles or materials to be used on the project.

C. Where any device or equipment is herein referred to in the singular number, such as "the panel", this reference shall be deemed to apply to as many such devices or equipment as are required to complete the installation as shown on the drawings or specified.

D. All materials and equipment used in the work shall comply with the standards of recognized authorities such as UL, NEMA, IEEE, ETL, IES and EIA in every instance where such standards have been established for the particular type of materials to be installed.

E. All similar pieces of equipment or materials of the same type or classification used for the same purpose shall be of the same manufacturer.

F. All manufactured equipment shall have factory applied finishes.

2.2 CONCRETE

A. Concrete shall be in accordance with Division 03, or ACI-613.

B. The 28-day minimum compressive strength shall be 3000 psi.

2.3 WARRANTY

A. Wherever in the specification sections of this division, reference is made to a specific warranty period, this warranty shall be in addition to and not a limitation of other rights the Owner may have against the Contractor under the contract documents.

PART 3 – EXECUTION

3.1 INSPECTION

A. Prior to performing the work, examine areas and conditions; check and verify all dimensions, under which the work is to be installed and notify the Architect in writing of conditions and dimensions detrimental to the proper and timely completion of the work. Do not proceed until authorization is given by the Architect.

3.2 LAYING OUT WORK

A. The Contractor is responsible for the accuracy of all lines, elevations, and measurements, grading and utilities and must exercise proper precaution to verify figures shown on drawings before laying out work and will be held responsible for any error resulting from his failure to exercise such precaution.

3.3 WORKMANSHIP

A. Install all work neat, trim, parallel and plumb with building lines in accordance with standard trade practice acceptable to the Architect.

3.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Protect all equipment and materials from damage during transportation, storage and installation.

3.5 PROTECTION

A. Protect all work, equipment and materials during construction up to the time of acceptance by the Owner.

Arrange and design the protection to prevent damage from infiltration or dust, debris, moisture, chemicals and water. Cap or plug electrical raceways.

B. Protect all surfaces against damage from welding, cutting, burning, or similar construction functions. This protection shall be accomplished by care in operations, covering and shielding. Special care is directed to exposed finished masonry, metal or wood surfaces and painted surfaces. Corrective measures required shall be accomplished by the trade which made the original installation when and as directed by the Architect at the expense of the Contractor.

C. Cover and protect all lighting fixtures as may be necessary until completion of the work. Replace damaged fixtures or damaged fixture parts as directed by the Architect at no cost to the Owner.

D. Do not install devices, polished metal fittings or parts until adjoining tile or masonry work is completed.

E. Maintain and replace protective covering when so directed by the Architect until the work is ready for acceptance.

3.6 CUTTING & PATCHING

A. Furnish information to the General Contractor as to sizes and locations of recesses required to install panel boxes and other equipment or devices. If the information is late or incorrect, this Contractor shall, at his own expense, have the trade which originally installed the work do the required cutting and patching.

B. Perform all cutting of concrete or other material for passage of raceways as required to install the work.

C. Close all such openings around raceways with material as specified under the heading "SEALING".

D. Install concealed work in place for the mason to wall-in as he carries up the walls; otherwise, this Contractor will be responsible as stated in the first paragraph.

3.7 SEALING

A. Where raceways pass through fire-rated walls and floors, seal opening with RTV foam.

B. Seal raceways entering the building to conform to the requirements of the NEC.

3.8 OFFSETS AND MODIFICATIONS

A. Furnish and install all offsets necessary to install the work and to provide clearance for the work of other trades.

B. Maintain adequate clearance as directed by the Architect/Engineer.

C. Incidental modifications necessary to the installation shall be made as necessary and at the direction and/or approval of the Architect.

3.9 SLEEVES

A. Furnish and install sleeves for all raceways passing through floors and walls. Sleeves shall be Schedule 40 galvanized steel pipe and shall extend 1" above finished floor surface. Where sleeves are set in interior walls, they shall finish flush with the wall.

B. Furnish and install watertight sleeves for all raceways extending through foundation walls into crawl spaces, mechanical rooms or basement areas from building exterior or from unexcavated areas to building interior. Sleeve shall consist of extra heavy pipe sleeve with anchor flange. Space between raceway and the sleeve shall be sealed with modular wall and casing seal similar to Thunderline Corporation "Link-Seal", Metraseal or approved substitute. Install seal in strict accordance with the manufacturer's recommendations.

3.10 EXCAVATION

A. The excavation shall be of the open-trench method and to the depths and widths as may be necessary. The Contractor shall do all excavation required in connection with his work. Bottoms of trenches shall be excavated to a uniform grade. All materials excavated shall be deposited on the side of the trenches and beyond the reach of slides. Excavated material shall not be piled where it will interfere with traffic.

B. No conduits shall be bedded directly on rock. They shall be cushioned by a 6-inch layer of crushed stone or gravel of selected grade, of size to pass through a 3/4" mesh sieve. Not less than 30% shall be fine which will pass through a 3/8" mesh sieve.

C. Where excavation is required through tree root areas, roots shall be saw cut, treated with pruning paint and covered with burlap. Burlap shall be wet and shall be protected and maintained in a moist condition during entire period of exposure. Backfill shall be carefully placed and hand-tamped to a minimum of 6" above roots.

D. Bidder shall base his estimate upon the presumption that all excavation required in the performance of this Contract will be earth. If rock is encountered, Contractor will be reimbursed for the additional work required to remove same based upon the unit cost established in the proposal.

E. All detached boulders or loose stone not exceeding 1 cubic yard, all topsoil, sand, gravel, clay, rubbish, walls or other subgrade construction, and all other materials of every name and nature which can be removed without breaking up with pneumatic breakers shall be considered earth excavation.

F. All rocks, attached boulders, boulders exceeding 1 cubic yard, walls or other subgrade construction and materials which cannot be removed without breaking up with pneumatic equipment shall be considered rock excavation.

G. Before commencing any rock excavation for which extra compensation is to be paid, a rock contour drawing shall be prepared by the Contractor and checked by the Architect. The width shall be based on 2'-0". This rock contour drawing and width allowance will be used to compute the quantity of rock for which the Contractor will be reimbursed at the unit price established.

3.11 SHORING AND PUMPING

A. The Contractor shall provide all shoring, bracing or sheet piling necessary to maintain the banks of his excavation and shall take out same as the work progresses and filling in has been accomplished. Shoring shall be in accordance with OSHA Standards.

B. The arrangement of shoring must be such as to prevent any movement of the trench banks and consequent strains on the conduits. Shoring shall be provided to prevent damage to work installed by other trades.

C. The Contractor shall do all pumping required to keep his excavations free of water. The water shall be conveyed in piping or watertight troughs a sufficient distance that it will flow from the site and not affect other work being performed.

3.12 BACKFILLING

A. After work in trenches has been completed, they shall be filled with good, clean, fine earth in 8" layers and shall be pneumatically tamped before the next layer of material has been filled in. The backfill shall be free of excavated rock, cinders, stones, brickbats or other debris.

B. Wherever rock is removed, the Contractor shall secure and fill select clean earth to a minimum depth of 3'-0" above the top of the conduit. Unless otherwise indicated, no rock shall be deposited in the trench fill. This clean earth fill shall be procured other than from the site unless permission for earth borrow from the site is granted by the Architect. If site borrow is permitted, the topsoil removal, relocation and finished grading will be accomplished as directed by the Architect.

C. Under no circumstances shall excavated material be left where it will interfere with the Owner's or other Contractor's operations.

D. All earth and other materials taken from the trenches and not required for backfilling shall be deposited where directed, or removed from the premises as directed by the Architect.

E. Any rock removed from the excavation shall be removed from the project site by the Contractor.

F. Trenches which pass under wall footings or within 18" of column footings shall be backfilled with clean concrete. To secure adequate foundation support, the method and depositing of the concrete fill shall be as directed by the Architect. To prevent the concrete from adhering to the conduits, necessary conduit protection shall be applied.

3.13 FOUNDATIONS FOR EQUIPMENT/HOUSEKEEPING PADS

A. Provide all foundations for equipment installed under this specification Division and/or as indicated on plans.

B. Construct concrete foundations on structural floor slabs or on grade in the manner or as required by the approved shop drawing details of the manufacturer or the utility company.

C. Provide and install concrete.

D. Metal reinforcement shall be deformed steel bars or cold drawn steel wire, or fabricated forms of these materials as required.

E. Furnish anchors of size and number noted, with bottom plates and sleeves.

F. Forms shall conform to the shape, lines, grades, and dimensions of the concrete, required by the approved shop drawing details of the equipment manufacturers, or approved on the Contractor's Equipment room layouts. They shall be sufficiently tight to prevent leakage of mortar and shall be

braced or tied together to maintain position and shape. Forms shall be moved in such manner as to insure the complete safety of the structure.

G. All exposed corners or edges shall be chamfered. All burrs, fins, irregularities of forming or spillage shall be removed and the surface float or trowel finished to a smooth, straight surface.

H. Housekeeping Pads: Provide 4" thick, and size as required by approved shop drawings, concrete pad for all equipment installed on floor. Pad shall be steel reinforced with all edges and surfaces finished as described above. When installing over existing concrete, surface of existing pad shall be prepped using a bushing tool to rough in entire surface. Whether pouring over new or existing concrete, provide U-shaped rebar anchors set in epoxy to secure pad to pad.

3.14 ITEMS RECESSED IN MASONRY CONSTRUCTION

A. Wherever boxes, electric panels, equipment, devices, access panels, and similar items of electrical construction are installed in exposed masonry construction, the Contractor shall utilize and submit for approval items of such size, height, and arrangement to conform to the corresponding masonry unit. The Contractor shall include as part of this contract, the necessary offsets, adjustments and relocations necessary to conform with the instructions of the Architect as to the final location of the equipment item in the exposed masonry.

B. As part of his contract and before the purchase of the items hereinbefore mentioned, the Contractor shall notify the Architect of such modifications in the building arrangement that will be necessary to accommodate the proposed equipment.

3.15 ROOF FLASHINGS

A. All conduit extending through roofs shall be provided with watertight flashing and counterflashing as hereinafter described.

B. Furnish and install standard counterflashing fittings on the conduit or properly designed clamped counterflashing with caulking as directed by the Architect/Engineer.

3.16 PAINTING

A. Refinish all factory applied finishes that have been damaged to match the original finish as directed by the Architect.

B. Prime coat all steel furnished under this Division with material and methods as described in another Section under the heading "PAINTING".

3.17 EQUIPMENT CONNECTIONS

A. Provide required wiring, raceways and final connections for all equipment provided by this Division and Divisions 1 thru 23.

B. Make final connections in accordance with wiring diagrams obtained from equipment manufacturer.

C. Rough-in in accordance with approved shop drawings from the manufacturer or supplier of the equipment. Rough-in prior to shop drawing approval will be subject to change without adjustment to contract cost.

3.18 BALANCING

A. The system of feeder and branch circuits for power and lighting shall be connected to panel busses in such a manner as to electrically balance the connected load as close as is practicable. Should the Owner disclose any unfavorable conditions reacting on the service, this Contractor shall make such changes as may be suggested to balance the load.

3.19 GUARANTEE

A. All work shall be guaranteed to be free from defects for a period of one year of operation from date of acceptance by the Owner unless otherwise specified in Division 1.

B. Guarantee shall be extended on an equal time basis for all non- operational periods due to failure within the guarantee period.

C. Contractor to include an 11 month “walk-thru” of the building system with representatives of the School District, Architect, Engineer and the Construction Manager. The purpose is to establish a list of corrective work that relates to operational issues, material/installation deficiencies.

END OF SECTION

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SECTION 26 05 00

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. This section is a Division 26 Basic Materials and Methods section and is part of each Division 26 Section making reference to wires and cables specified herein.

1.2 DESCRIPTION OF WORK

A. Electrical wire and electrical cable work is indicated by drawings and specifications.

B. Types of wire, cable and connectors in this section include, but not limited to the following:

Copper conductors.

Tap type connectors.

Split-bolt connectors.

C. Refer to other sections of Division 26 for, but not limited to, raceways, connections used in conjunction with wire and cable work.

D. Applications for wire, cable and connectors required for project are as follows unless otherwise indicated:

1. Power Distribution Circuitry.
2. Appliance and Equipment Circuitry.
3. Motor Branch Circuitry.
4. Control Circuitry.
5. Signal/Communication Circuitry.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. <u>Wire and Cable</u>

Anaconda Wire and Cable Co.

Advance Wire and Cable, Inc.

American

Cerro Wire and Cable Co.

Electrical Conductors, Inc.

General Cable Corp.

Rome Cable Corp.

Southwire Company

Triangle PWC,, Inc.

General Electric Co.

<u>Connectors</u>

Burndy Corp.

Eagle Electric Mfg. Co., Inc.

Gould, Inc.

Ideal Industries, Inc

Joslyn Mfg. and Supply Co.

O-Z/Gedney Co.

Pyle National Co.

Thomas and Betts Co.

2.2 WIRE, CABLE AND CONNECTIONS

A. Except as otherwise indicated, provide wire, cable and connectors of manufacturer's standard materials, as indicated by published product information; designed and constructed as recommended by manufacturer, and as required for the installation. Minimum wire and cable size is #12 AWG for power and branch circuits and #14 AWG for control and signal/communication circuits unless otherwise indicated.

B. Wire: Provide factory fabricated wire of sizes, ratings, materials and types indicated for each service. Where not indicated, provide proper selection as determined by Installer to comply with project's installation requirements and NEC standards. Select from the following types, materials, conductor configurations, insulation and coverings:

UL Type: THHN

UL Type: TW

UL Type: THW

UL Type: THWN

UL Type: TF

UL Type: XHHW

UL Type: AC (Armor Clad)

UL Type: MC (Metal Clad)

Material: Copper

Conductors: Solid (AWG 14 to AWG 10 only).

Conductors: Concentric-lay-stranded (standard flexibility)

Outer Covering: Nylon

Outer Covering: Thermoplastic

C. Connectors: Provide factory fabricated metal connectors of sizes, ratings, materials, types and classes as required for each service. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements and NEC standards. Select from the following types, classes, kinds and styles.

Type: Pressure

Type: Crimp

Type: Threaded

Class: Insulated

Class: Non-insulated

Kind: Copper (for CU to Cu connection).

Style: Butt connection

Style: Elbow connection

Style: Combined "T" and straight connection

Style: "T" connection.

Style: Split-bolt parallel connection

Style: Tap connection

Style: Pigtail connection

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install electrical cables, wires and connectors, in compliance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation", and in accordance with recognized industry practices.

B. Coordinate cable and wire installation work with electrical raceway and equipment installation work, as necessary for proper interface. Pull conductors together where more than one is being installed in a raceway. Use pulling compound or lubricate, where necessary; compound must not deteriorate conductor or insulation. Use pulling means including fish tape, cable or rope which cannot damage raceway. Rope must be used as pulling means when pulling wires or cables into plastic conduit and duct. Keep conductor splices to a minimum and install in junction boxes only. No splices shall be permitted within conduit. Install splices and tapes which have mechanical strength and insulation rating equivalent or better than conductor. Use splice and tape connectors which are compatible with conductor material.

3.2 FIELD QUALITY CONTROL

A. Prior to energization, test cable and wire for continuity of circuitry and also for short circuits. Correct malfunctions when detected.

B. Subsequent to wire and cable hook-ups, energize circuitry and demonstrate functioning in accordance with requirements.

END OF SECTION

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SECTION 26 05 19.01
DISTRIBUTION CIRCUITS

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. Distribution circuit work is indicated by drawings and schedules.

B. The distribution circuits shall include furnishing and installing a complete wire and conduit system between distribution panelboards and branch circuit panelboards.

C. Types of equipment to be furnished and installed in this section include the following:

Rigid Metal Conduit

Intermediate Metal Conduit (IMC)

Electrical Metallic Tubing (EMT)

PVC (Below Slab Only)

Wires and Cables

Junction Boxes

Pull Boxes

Conduit Bodies

Bushings

Locknuts

Supporting Devices

PART 2 – PRODUCTS

2.1 DISTRIBUTION CIRCUITS

A. Furnish and install each distribution circuit indicated, with assembly of materials, including but not necessarily limited to, conduit, wire, pull boxes, junction boxes and other items and accessories needed for a complete installation. Where materials or components are not otherwise indicated, comply with NEC, NEMA and established industry standards for applications indicated.

PART 3 – EXECUTION

3.1 INSTALLATION OF DISTRIBUTION CIRCUITS

A. Install distribution circuits complying with equipment manufacturer's written instructions, applicable requirements of NEC, NEMA, and NECA's "Standard of Installation", and in accordance with recognized industry practices.

B. Multiple circuits within a single raceway shall not be permitted under this section.

END OF SECTION

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SECTION 26 05 19.02
FEEDER CIRCUITS

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. Feeder circuit work is indicated by drawings and schedules.

B. The feeder circuits shall include furnishing and installing a complete wire and conduit system between distribution panelboards and major 3 phase loads, between power panels and 3 phase motor loads.

C. Types of equipment to be furnished and installed in this section include the following:

Rigid Metal Conduit

Electrical Metallic Tubing (EMT)

Intermediate Metal Conduit (IMC)

Wires and Cables

Junction Boxes

Pull Boxes

Conduit Bodies

Bushings

Locknuts

Supporting Devices

PART 2 – PRODUCTS

2.1 FEEDER CIRCUITS

A. Furnish and install each feeder circuit with assembly of materials, including but not necessarily limited to, conduit, wire, pull boxes, junction boxes and other items and accessories needed for a complete installation. Where materials or components are not otherwise indicated, comply with NEC, NEMA and established industry standards for applications indicated.

PART 3 – EXECUTION

3.1 INSTALLATION OF FEEDER CIRCUITS

A. Install feeder circuits, complying with equipment manufacturer's written instructions, applicable requirements of NEC, NEMA and NECA's "Standard of Installation", and in accordance with recognized industry practices.

B. Multiple circuits within a single raceway shall not be permitted under this section.

END OF SECTION

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SECTION 26 05 19.03
BRANCH CIRCUITS

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. Branch circuit work is indicated by drawings.

B. The branch circuits shall include furnishing and installing a complete wire and conduit or cable system between panelboards and lighting fixtures, receptacles, fractional horsepower motors, and small single-phase loads.

C. Types of equipment to be furnished and installed in this section include the following:

Rigid Raceways – See Section 26 05 33.

Electrical Metallic Tubing (EMT)

MC (Metal Clad) (Concealed Work only)

Wires and Cables

Junction Boxes

Pull Boxes

Conduit Bodies

Bushings

Locknuts

Supporting Devices

PART 2 – PRODUCTS

2.1 BRANCH CIRCUITS

A. Furnish each branch circuit with an assembly of materials, including but not necessarily limited to, conduit, wire, cable, pull boxes, junction boxes and other items and accessories needed for a complete installation. Where materials or components are not otherwise indicated, comply with NEC, NEMA and established industry standards for applications indicated.

2.2 CONVENIENCE BRANCH CIRCUITS

A. Intent:

1. The intent of this portion of the specifications is to describe the requirements of a convenience circuit as it applies to 120-volt receptacles.
2. All convenience branch circuits may consist of more than one 120-volt receptacle.

B. Convenience Circuit - General: A circuit consisting of a phase and neutral conductor, which may share its neutral with other phase conductors provided that the neutral conductor does not become overloaded due to circuit phase relationship. This type of circuit shall also include an equipment grounding conductor as described under the grounding section of the specifications.

C. Convenience Circuit - Dedicated: A circuit consisting of a phase and neutral conductor which DOES NOT share conductors with any other circuits. This type of circuit shall also include an equipment grounding conductor as described under the grounding section of the specifications.

D. Convenience Circuit Dedicated with Isolated Ground: A circuit consisting of a phase, neutral and ground conductor which DOES NOT share conductors with any other circuits. This type of circuit shall also include an equipment grounding conductor as described under the grounding section of the specifications.

1. The isolated ground conductor shall be connected to an isolated ground type receptacle as described under the Wiring Devices Section of the specifications.
2. The isolated ground conductor shall be identified by green insulation with a yellow stripe.
3. The isolated ground conductor shall be connected to an isolated ground bar in the branch circuit panelboard. This isolated ground bar shall then be connected to an applicable derived system ground or service entrance ground.

PART 3 – EXECUTION

3.1 INSTALLATION OF BRANCH CIRCUITS

A. Install branch circuits, complying with equipment manufacturer's written instructions, applicable requirements of NEC, NEMA, and NECA's "Standard of Installation", and in accordance with recognized industry practices.

B. Multiple circuits within a single raceway or cable shall be permitted under this section. It shall be the responsibility of the Electrical Contractor to assure that the neutral conductors do not become overloaded due to circuit phase relationship, and isolated grounds not become voided or compromised due to miswiring or wrong connections.

C. The Electrical Contractor may elect to use metal clad cable in lieu of electrical metallic tubing (EMT) in wall cavities, and/or above tile or dry wall ceilings. In all areas of exposed construction, electrical metallic tubing (EMT) shall be installed.

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. Types of grounding in this section include the following:

Grounding:

Underground metal piping.

Underground metal water piping.

Grounding rods.

Service equipment.

Enclosures.

Systems.

Equipment.

Building Structural Steel (Bonding)

PART 2 – PRODUCTS

2.1 GROUNDING

A. Except as otherwise indicated, provide each electrical grounding system indicated, with assembly of materials including, but not necessarily limited to, cables/wires, connectors, terminals (solderless lugs), and other items and accessories needed for complete installation. Where materials or components are not otherwise indicated, comply with NEC, NEMA, and established industry standards for applications indicated.

B. Provide conduit, tube, duct, cable and fittings complying with Division 26, in accordance with the following listing:

Rigid steel conduit.

Electrical metallic tubing.

Flexible metal conduit.

Liquid-tight flexible metal conduit.

Rigid metal conduit fittings.

EMT fittings.

Flexible metal conduit fittings.

Liquid-tight flexible metal conduit fittings.

2.2 ELECTRICAL GROUNDING CONDUCTORS

A. Unless otherwise indicated, furnish a green insulated equipment grounding conductor for all feeders and branch circuits, matching power supply wiring materials and sized according to NEC.

2.3 BONDING PLATES, CONNECTIONS, TERMINALS & CLAMPS

A. Provide electrical bonding plates, connectors, terminals and clamps as recommended by bonding plate, connector, terminal and clamp manufacturers for applications.

2.4 GROUND RODS & PLATES

A. Ground Rods: Steel with copper welded exterior, 3/4" dia. x 10'.

PART 3 – EXECUTION

3.1 INSTALLATION OF GROUNDING SYSTEMS

A. Install electrical grounding systems in accordance with manufacturer's written instructions and with recognized industry practices to ensure grounding complies with requirements. Comply with requirements of NEC, NESC, NEMA and UL standards for installation of grounding systems.

B. Coordinate with other electrical work as necessary to interface installation of grounding system with other work.

C. Clamp cable connections to ground rods.

D. Install bonding jumpers with ground clamps on water meter piping to electrically bypass water meter.

E. Install clamp-on connectors only on thoroughly cleaned metal contact surfaces, to ensure electrical conductivity and circuit integrity.

3.2 FIELD QUALITY CONTROL

A. Upon completion of installation of electrical grounding system, test ground resistance with ground resistance tester. Where tests show resistance-to-ground is over 25 ohms, take appropriate action to reduce resistance to 25 ohms or less by driving additional ground rods and/or by chemically treating soil encircling ground rods with sodium chloride, calcium chloride, copper sulphate, or magnesium. Then retest to demonstrate compliance.

END OF SECTION

SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. Types of supports, anchors, sleeves and seals specified in this section include the following:

Hangers.

Riser Clamps.

C-clamps

I-beam clamps.

One-hole conduit straps.

Two-hole conduit straps.

Round steel rods.

Lead expansion anchors.

Toggle bolts.

U-Channel Strut Systems.

PART 2 – PRODUCTS

2.1 MANUFACTURED SUPPORTING DEVICES

A. Provide supporting devices, complying with manufacturer's standard materials, design and construct in accordance with published product information, and as required for a complete installation, and as herein specified.

B. Supports: Provide supporting devices of types, sizes and materials having the following construction features:

Hangers: For supporting EMT conduit, electro-galvanized steel, with 1/4" minimum diameter hole for round steel rod; approximately MSS types 5, 7, 9 or spring steel conduit clips.

Reducing Couplings: Steel rod reducing coupling, 1/4" minimum black steel.

C-Clamps: Black malleable iron, 1/4" minimum rod size.

I-Beam Clamps: Black steel, 1-1/4" x 3/16" stock; 3/8" cross bolt; flange width 2"; approx. 52 pounds per 100 units.

One-Hole Conduit Straps: For supporting EMT conduit, electro- galvanized steel.

Two-Hole Conduit Straps: For supporting EMT conduit, electro-galvanized steel; 3/4" strap width; and 2-1/8" between center of screw holes.

Hexagon Nuts: For 1/4" rod size; galvanized steel.

Round Steel Rod: Black steel; 1/4" min. dia.

Offset Conduit Clamps: For supporting rigid metal conduit; black steel.

C. Anchors: Provide anchors of types, sizes and materials indicated; and having the following construction features:

Lead Expansion Anchors: 1/4" - 20 Minimum.

Toggle Bolts: Springhead; 3/16 x 4".

D. Manufacturer: Subject to compliance with requirements, provide anchors of the following:

Ackerman Johnson Fastening Systems, Inc.

Elcen Metal Products Co.

Ideal Industries, Inc.

Rawlplug Co., Inc.

Star Expansion Co.

U.S. Expansion Bolt Co.

Erico Products, Inc. (Caddy)

Hilti, Inc.

E. U-Channel Strut Systems: Provide U-channel strut system for supporting electrical equipment, 16-gauge hot dip galvanized steel, construct with 9/16" dia. holes, 8" o.c. on top surface, with standard hot dip galvanized finish, and with the following fittings which mate and match with U-channel.

Beam clamps.

Thinwall conduit clamps.

Conduit hangers.

U-bolts.

F. Manufacturers: Subject to compliance with requirements, provide channel systems of one of the following:

B-Line Systems, Inc.

Elcen Metal Products Co.

Power-Strut Div.; Van Huffel Tube Corp.

Unistrut Div.; GTE Products Corp.

Hilti, Inc.

PART 3 – EXECUTION

3.1 INSTALLATION OF SUPPORTING DEVICES

A. Install hangers and anchors in accordance with manufacturer's written instructions and with recognized industry practices to insure supporting devices comply with requirements. Comply with requirements of NECA, NEC and ANSI/NEMA for installation of supporting devices.

B. Install hangers, supports, clamps and attachments to support piping properly from building structure. Arrange for grouping of parallel runs of horizontal conduits to be supported together on trapeze type hangers where possible. Install supports with maximum spacings.

END OF SECTION

SECTION 26 05 33.16
BOXES FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. This section is a Division 26 Basic Materials and Methods section, and is a part of each Division 26 section making reference to electrical wiring boxes and fittings specified herein.

1.2 DESCRIPTION OF WORK

A. Types of electrical boxes and fittings in this section include the following:

Outlet boxes.

Junction boxes.

Pull boxes.

Conduit bodies.

Bushings.

Locknuts.

Knockout closures.

PART 2 – PRODUCTS

2.1 INTERIOR METALLIC OUTLET BOXES

A. Provide galvanized flat rolled sheet steel interior outlet non-gangable wiring boxes, of types, shapes and sizes, including box depths, to suit each respective location and installation; construct with stamped knockouts in back and sides and with threaded screw holes with corrosion-resistant screws for securing box covers and wiring devices.

B. Provide outlet box accessories as required for each installation, including mounting brackets, wallboard hangers, extension rings, fixture studs, cable clamps and metal straps for supporting outlet boxes, which are compatible with outlet boxes being used and fulfilling requirements of individual wiring situations. Choice of accessories is Installer's option.

C. Manufacturer: Subject to compliance with requirements, provide interior outlet boxes of one of the following:

Appleton Electric Co.

Bell Electric/Square D Co.

Pass and Seymour, Inc.

RACO, Inc.

Steel City/Midland-Ross Corp.

2.2 WEATHERPROOF OUTLET BOXES

A. Provide corrosion resistant cast-metal weatherproof outlet wiring boxes, of types, shapes and sizes, including depth of boxes, with threaded conduit ends, cast-metal face plates with spring-hinged waterproof caps suitably configured for each application, including face plate gaskets and corrosion-resistant fasteners.

B. Manufacturer: Subject to compliance with requirements, provide weatherproof outlet boxes of one of the following:

Arrow-Hart Div., Crouse-Hinds Co.

Bell Electric/Square D Co.

Harvey Hubbell, Inc.

O-Z/Gedney Co.

Slater Electric Co.

C. Refer to Section 26 27 26 – WIRING DEVICES for exterior receptacle outlet boxes.

2.3 JUNCTION PULL BOXES

A. Provide galvanized code-gauge sheet steel junction and pull boxes, with screw-on covers; of types, shapes and sizes, to suit each respective location and installation; with welded seams and equipped with stainless steel nuts, bolts, screws and washers.

B. Manufacturers: Subject to compliance with requirements, provide junction and pull boxes of one of the following:

Adalet-PLM Div., Scott and Fetzer Co.

Appleton Electric Co.

Arrow-Hart Div., Crouse-Hinds Co.

Bell Electric/Square D Co.

GTE Corporation

Keystone Columbia, Inc.

O-Z/Gedney Co.

Slater Electric Co.

Spring City Elect. Mfg. Co.

2.4 CONDUIT BODIES

A. Provide galvanized cast-metal conduit bodies, of types, shapes, and sizes, to suit respective locations and installation, construct with threaded-conduit-entrance ends, removable covers, and corrosion-resistant screws.

B. Manufacturers: Subject to compliance with requirements, provide conduit bodies of one of the following:

Appleton Electric Co.

Crouse-Hinds Co.

Gould, Inc.

Killark Electric Mfg. Co.

O-Z/Gedney Co.

Spring City Electrical Mfg. Co.

2.5 BUSHINGS, KNOCKOUT CLOSURES AND LOCKNUTS

A. Provide corrosion-resistant punched-steel box knockout closures, conduit locknuts and insulated malleable iron conduit bushings, offset connectors, of types and sizes to suit respective uses and installation.

B. Manufacturers: Subject to compliance with requirements, provide bushings, knockout closures, locknuts and connectors of one of the following:

Appleton Electric Co.

Burndy Corp.

Crouse-Hinds Co.

Gould, Inc.

O-Z/Gedney Co.

RACO, Inc.

Steel City/Midland-Ross Corp.

Thomas and Betts Co., Inc.

PART 3 – EXECUTION

3.1 INSTALLATION OF ELECTRICAL BOXES AND FITTINGS

A. Install electrical boxes and fittings, complying with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.

B. Coordinate installation of electrical boxes and fittings with wire/cable and raceway installation work.

C. Provide weatherproof outlets for interior and exterior locations exposed to weather or moisture.

D. Provide knockout closures to cap unused knockout holes where blanks have been removed.

E. Install boxes and conduit bodies in those locations to ensure ready accessibility of electrical wiring.

F. Avoid using round boxes where conduit must enter box through side of box, which would result in difficult and insecure connections when fastened with locknut or bushing on rounded surface.

G. Fasten boxes rigidly to substrates or structural surfaces to which attached, or solidly embed electrical boxes in concrete or masonry.

H. Provide electrical connections for installed boxes.

I. Pull boxes and junction boxes shall be furnished and installed in all conduit runs at intervals not exceeding 100 feet maximum.

J. Identify each circuit in all pull boxes and junction boxes whether the box contains one or more circuits.

END OF SECTION

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SECTION 26 05 33

RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. The general provisions of the Contract, including the Conditions of the Contract (General, Supplementary and other conditions, if any) and Division 1 as appropriate, apply to the Work specified in this Section.

B. Refer to Section 26 00 00 for Electrical.

1.2 DESCRIPTION OF WORK

A. Types of raceways in this section include the following:

Rigid metal conduit

Intermediate metal conduit

Electrical metallic tubing.

Polyvinyl chloride conduit (Exterior Underground Only)

Flexible metal conduit.

Liquid-tight flexible metal conduit.

Wireways.

1.3 REFERENCE STANDARDS

A. Refer to Section 26 00 00 for a general description of requirements applying to this Section.

1.4 QUALITY ASSURANCE

A. Refer to Section 26 00 00 for a general description of requirements applying to this Section.

1.5 WARRANTY/GUARANTEE

A. All work and materials are subject to the general warranty as described in the General Conditions of the Contract and in Division 1, GENERAL REQUIREMENTS.

1.6 COORDINATION

A. The drawings and details there upon are scheme and/or diagrammatic in nature, and indicate the need and intent of the design. These are to be used for general guidance only. It shall be the responsibility of the Electrical Contractor to coordinate, with other Division Subcontractors, the installation of all raceways, raceway supports, junction boxes and required fittings. This coordination will include conduit layout to allow access to equipment for maintenance.

B. This coordination shall be carried out prior to actual installation; this shall be done to eliminate the possibility of conflicts between trades on items such as access, clearances and maintenance issues that may arise after completion of construction.

C. Should the coordination not be carried out prior to installation, and a conflict exists, the installing contractor shall remove and reinstall the equipment as required to clear the conflict at no additional cost to the Owner and no delay in project completion.

PART 2 – PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. <u>Rigid Metal Conduit</u>:

1. Raceway: Full weight, heavy wall rigid steel with zinc coating conforming to ANSI-C80.1.

2. Fittings: Cast malleable iron fittings with threaded hubs, insulated throat and zinc protective coating.
3. Subject to compliance with requirements, provide products of one of the following:

   Allied Tube and Conduit Corporation

   LTV Steel Tubular Products Co.

   Wheatland Tube

B. Intermediate Metal Conduit:

1. Raceway: Light weight, rigid steel, hot dipped galvanized manufactured in accordance with UL1242.
2. Fittings: Cast malleable iron fittings with threaded hubs, insulated throat and zinc protective coating.
3. Subject to compliance with requirements, provide products of one of the following:

   Allied Tube and Conduit Corporation

   LTV Steel Tubular Products Co.

   Wheatland Tube

C. Electrical Metallic Tubing:

1. Raceway: Light weight, thin wall, rigid steel, hot dipped galvanized manufactured in accordance with ANSI C80.3.
2. Fittings: Raintight, insulated throat, compression type with zinc protective coating.
3. Subject to compliance with requirements, provide products of one of the following:

   Allied Tube and Conduit Corp.

   LTV Steel Tubular Products Co.

   Wheatland Tube Co.

D. Polyvinyl Chloride Conduit:

1. Raceway: Heavy wall, rigid non-metallic, schedule 40 with bell type end, designed for above ground exposed applications, direct earth burial, and concrete encasement.
2. Fittings: Polyvinyl chloride, heavy duty, glue type, designed for Schedule 40 application.
3. Subject to compliance with requirements, provide products of one of the following:

   Allied Tube & Conduit

   Carlon

   Queen City Plastics, Inc.

   Scepter Electric Systems

E. Flexible Metal Conduit:

1. Raceway: Construct of single strip, flexible, continuous, interlocked, and double-wrapped steel, galvanized inside and outside.
2. Fittings: Steel, insulated throat, with zinc protective coating.
3. Subject to compliance with requirements, provide products of one of the following:

   AFC

   Alflex Corp.

   Electri-Flex Company

F. Liquid-Tight Flexible Metal Conduit:

1. Raceway: Construct of single strip, flexible, continuous, interlocked, and double-wrapped, galvanized inside and outside, coat with liquid-tight jacket of flexible polyvinyl chloride.
2. Fittings: Steel, water and oiltight, insulated throat, with zinc protective coating.
3. Subject to compliance with requirements, provide products of one of the following:

   AFC

   Alflex Corp.

   Electri-Flex Company

G. Wireways:

1. Furnish electrical wireways of the type, size, and style for each service indicated. Wireway shall be a complete assembly including but not necessarily limited to, couplings, offsets, elbows, adapters, hold-down clips, end-caps and other components and accessories as needed for a complete system.
2. System shall fulfill wiring requirements as indicated in contract documents, and shall comply with applicable portions of Article 362 of the National Electrical Code.
3. Subject to compliance with requirements, provide products of one of the following:

   Circle AW Products Co.

   The EMF Company, Inc.

   Hoffman Engineering Company

   Square "D" Company

H. The above items shall include the statement "Approved Equal" and/or "Approved Substitute". This statement requires that the product or item be in compliance with the written intent of this specification and the submission meets the requirements of Section 260000.

PART 3 – EXECUTION

3.1 INSTALLATION OF ELECTRICAL RACEWAYS

A. Install electrical raceways in accordance with manufacturer's written instructions, applicable requirements of NEC and NECA "Standard of Installation", and complying with recognized industry practices.

B. Coordinate with other work as necessary to interface installation of electrical raceways, wireways and required components.

C. Raceways used for distribution, feeders, or branch circuits shall be a minimum size of 3/4" or equal equivalent cross-sectional area. Raceways used for control and signal shall be a minimum size of 1/2" or equal equivalent cross-sectional area.

D. All raceways shall be concealed within the building construction, where indicated on the floor plans surface raceway shall be installed. Should it be impossible or impracticable to install a raceway concealed and surface raceway is not indicated, the Contractor shall consult with the Architect or Engineer for approval prior to installation.

E. All raceways installed in ceiling cavities and exposed within mechanical spaces shall be run parallel with building lines and installed level and square at the proper elevation/height.

F. Complete the installation of electrical raceways before starting the installation of cables/wires within the raceway.

G. Furnish and install one (1) nylon or fiberglass pull cord in each empty raceway. Each empty raceway shall be cleaned, capped, and tagged as to its termination location.

H. Install liquid-tight flexible metal conduit for connections to motors and for other electrical equipment when subject to movement and vibration, and also where subjected to one or more of the following conditions:

1. Exterior locations.
2. Moist or humid atmosphere when condensation can be expected to accumulate.
3. Corrosive atmosphere.
4. Subjected to water spray.
5. Subjected to dripping oil, grease or water.

I. Install Electrical Metallic Tubing for building interior electrical work except:

1. Underground
2. In gravel, cinder, concrete or other sub-base floor construction.
3. Horizontal runs in concrete floor slabs.
4. Where exposed to the elements.
5. In masonry construction below finished grade.
6. Vertically in poured concrete walls.

J. Refer to Section 260000 for excavation, shoring and pumping, concrete and backfilling requirements.

K. Where and whenever possible, install horizontal electrical raceways as tight to building construction as possible and above water, drain and steam piping. A separation of at least six (6) inches shall be maintained between electrical conduits and hot water and steam piping.

L. In accordance with NEC requirements, install Rigid or Intermediate Metal Conduit where Electrical Metallic Tubing is not permitted.

M. In all instances where recessed type panelboards are installed, furnish and install one (1) one-inch raceway for each two (2) future circuits for which "space" or "spare" provisions have been made in the panelboard. These raceways shall extend between the panelboard cabinet and a convenient location above an access panel or a removable tile ceiling construction and capped.

3.2 CLEANING

A. Upon completion of installation of raceways, inspect interiors of raceways; remove burrs, dirt and construction debris.

END OF SECTION

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. This section is a Division 26 Basic Materials and Methods Section, and is part of each Division 26 Section making reference to electrical identification specified herein.

1.2 DESCRIPTION OF WORK

A. Types of electrical identification specified in this section include the following:

Cable conductor identification.

Operational instructions and warnings.

Danger signs.

Equipment/system identification signs.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide products of one of the following (for each type of marker):

W. H. Brady Co.

Ideal Industries, Inc.

Seton Name Plate Co.

3M Electrical Products

2.2 ELECTRICAL IDENTIFICATION MATERIALS

A. Provide manufacturer's standard products of categories and types required for each application. Where more than single type is specified for an application, selection is Installer's option, but provide single selection for each application.

2.3 COLOR-CODED PLASTIC TAPE

A. Provide manufacturer's standard vinyl tape not less than 7 mils thick by 3/4" wide.

B. Colors: Unless otherwise indicated or required by governing regulations, provide tape color as indicated in Paragraph 3.2.B.

C. Tape shall be of Type 3M Scotch 35 for color coding, Scotch Super 33+ for splices and Tem Flex 1700 for general use.

2.4 CABLE/CONDUCTOR IDENTIFICATION BANDS

A. Provide manufacturer's standard vinyl cloth, self-adhesive cable/conductor markers of wrap-around type; either pre-numbered, plastic-coated type, or write-on type with clear plastic, self-adhesive cover flap; numbered to show circuit identification.

2.5 BAKED ENAMEL DANGER SIGNS

A. Provide manufacturer's standard "DANGER" signs of baked enamel finish on 20-gage steel; of standard red, black and white graphics; 14" x 10" size except where 10"x 7"is the largest size which can be applied where needed, and except where larger size is needed for adequate vision; with recognized standard explanation wording (as examples: HIGH VOLTAGE, KEEP AWAY, BURIED CABLE, DO NOT TOUCH SWITCH).

2.6 ENGRAVED PLASTIC-LAMINATE SIGNS

A. Provide engraved stock melamine plastic laminate, in sizes and thicknesses indicated, engraved with engraver's standard letter style of sizes and wording indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.

B. Thickness: 1/16" for units up to 20 sq. in. or 8" length; 1/8" for larger units.

C. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate substrate.

2.7 LETTERING AND GRAPHICS

A. Coordinate names, abbreviations and other designations used in electrical identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of electrical systems and equipment.

PART 3 – EXECUTION

3.1 APPLICATION AND INSTALLATION

A. Coordination: Where identification is to be applied to surfaces which require finish, install identification after completion of painting.

B. Regulations: Comply with governing regulations and requests of governing authorities for identification of electrical work.

3.2 CABLE/CONDUCTOR IDENTIFICATION

A. Apply cable/conductor identification on each cable and conductor in each box/enclosure/cabinet where wires of more than one circuit or communication/signal system are present. Match identification with marking system used in panelboards, shop drawings, contract documents, and similar previously established identification for project electrical work.

B. Conductor Color Coding:

1. All conductors used in all systems shall have insulation that is inherently colored. All conductors of a system performing the same function shall be colored alike throughout the project.

2. Equipment Grounding Conductors:

a. Standard and/or general feeders or circuits shall be green.

b. Isolated feeders or circuits shall be green with yellow stripe.

3. On larger conductors, where colored insulation is not available, colored tape adhesive vinyl bands 3/4" width may be installed 6" maximum from the end of the conductors. Where passing through pull boxes without splice, each conductor shall be banded.

4. Power system conductor colors shall be as follows:

a. 120/208 Volt System

Phase A - Black

Phase B - Red

Phase C - Blue

Neutral - White or Gray

b. 277/480 Volt System

Phase A - Brown

Phase B - Orange

Phase C - Yellow

Neutral - White or Gray

3.3 DANGER SIGNS

A. In addition to installation of danger signs required by governing regulations and authorities, install appropriate danger signs at locations indicated and at locations subsequently identified by Installer of electrical work as constituting similar dangers for persons in or about project.

B. High Voltage: Install danger signs wherever it is possible, under any circumstances, for persons to come into contact with electrical power voltages higher than 110-120 volts.

3.4 EQUIPMENT/SYSTEM IDENTIFICATION

A. Install engraved, plastic laminate sign on each major unit of electrical equipment in building, including central or master unit of each electrical system including communication/signal systems, unless unit is specified with its own self-explanatory identification or signal system. Except as otherwise indicated, provide single line of text, 1/2" high lettering on 1-1/2" high sign (2" high where 2 lines are required), white lettering in black field. Provide text matching terminology and numbering of the contract documents and shop drawing. Provide signs for each unit of the following categories of electrical work:

1. Panelboards, electrical cabinets and enclosures.
2. Access panel/doors to electrical facilities.
3. Major electrical switchgear, main and feeder circuit breakers and/or disconnects..
4. Power transfer equipment.
5. Fire Alarm Master Station and Annunciator.
6. Paging and Intercommunication Systems
7. Security Control Panels and Annunciator.

B. Install signs at locations for best convenience of viewing without interference with operation and maintenance of equipment. Secure to substrate with fasteners, except use adhesive where fasteners should not or cannot penetrate the substrate.

3.5 JUNCTION AND PULL BOX IDENTIFICATION

A. Emergency Systems: Each junction and pull box cover shall be painted orange. Use black indelible liquid marker to label "EMERG." in 3/8" letters minimum.

B. Fire Alarm System: Each junction and pull box cover shall be painted red. Use black indelible liquid marker to label "F.A." in 3/8" letters minimum.

C. Feeders Shown on Single Line Diagram: Each junction and pull box shall be marked with black indelible liquid marker with the assigned feeder number "FDR #38" in 3/8" letters minimum.

END OF SECTION

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SECTION 26 05 73

OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. Short Circuit Coordination Study:

1. Short circuit studies, protective device evaluation studies and protective device coordination studies shall be performed by the switchboard manufacturer. The studies shall be submitted to the Engineer prior to receiving final approval of the distribution equipment shop drawings and/or prior to release of equipment for manufacture.
2. The studies shall include all portions of the electrical distribution system from the utility service equipment to all downstream distribution and branch panelboards, including normal and emergency equipment.

B. Arc Fault Calculations and Labeling:

1. Complete arc fault available current calculations and labeling shall be provided by the Electrical Contractor. Calculations may be performed by a subcontractor such as the switchboard manufacturer. Calculations shall be submitted to the Engineer prior to manufacture of labels, for review and approval.
2. Calculations shall include all portions of the electrical distribution system from the utility service equipment to <u>all</u> downstream distribution and branch panelboards; and from generator to <u>all</u> emergency distribution and transfer switches.
3. Electrical Contractor shall provide permanent labels on all electrical distribution system equipment as listed above. Labels shall indicate maximum available arc fault current per NEC 2011, Article 110. In addition, labels shall indicate level of personal protective equipment appropriate for the hazard, as defined in NFPA 70E.

2.1 DATA ACQUISITION

A. DATA COLLECTION FOR THE STUDIES

1. The Contractor shall provide the required data for preparation of the studies. The switchboard manufacturer shall furnish the contractor with a listing of the required data immediately after award of the contract.
2. The Contractor shall expedite collection of the data to assure completion of the studies as required for final approval of the distribution equipment shop drawings and/or prior to release of the equipment for manufacture.
3. The Contractor shall be responsible for provision of all feeder lengths required for all calculations.

B SHORT CIRCUIT AND PROTECTIVE DEVICE EVALUATION STUDY

1. The short circuit study shall be performed with the aid of a digital computer program and shall be in accordance with ANSI C37.5-1969 (R1975), IEEE Std. 320-172 and IEEE Std. 141-1976.
2. The study input data shall include the Power Company's short circuit contribution, resistance and reactance components of the branch impedances, the X/R ratios, base quantities selected, and other source impedances. This data shall be obtained by the contractor from the Utility Company.
3. Short circuit close and latch duty values and interrupting duty values shall be calculated on the basis of assumed three-phase bolted short circuits at each switchgear bus, medium voltage controller, switchboard, low voltage motor control center, distribution panelboard, pertinent branch circuit panel and other significant locations through the system. The short circuit tabulations shall include symmetrical fault currents and X/R ratios. For each fault location, the

total duty on the bus, as well as the individual contribution from each connected branch, shall be listed with its respective X/R ratio.

4. A protective device evaluation of circuit breakers, disconnect switches, and fuses by tabulating and comparing the short circuit ratings of these devices with the calculated fault currents. Appropriate multiplying factors based on system X/R ratios and protective device rating standards shall be applied. Any problem areas or inadequacies in the equipment due to short circuit currents shall be promptly brought to the Engineer's attention.

C PROTECTIVE DEVICE COORDINATION STUDY

1. A protective device coordination study shall be performed to provide the necessary calculations and logic decisions required to select the protective relay characteristics and settings, ratios and characteristics of associated current transformers, and low voltage breaker trip characteristics and settings.
2. The coordination study shall include all medium and low voltage classes of equipment from the building service protective devices down to and including the largest rated device in the MCC low voltage motor control center and panelboard. The phase and ground overcurrent protection shall be included as well as settings of all other adjustable protective devices.
3. The time-current characteristics of the specified protective devices shall be drawn on Keuffel and Esser Log - log paper. The plots shall include complete titles, representative one-line diagram and legends, significant motor starting characteristics, complete parameters of transformers, complete operating bands of low voltage circuit breaker trip curves and fuses. The coordination plots shall indicate the types of protective devices selected, proposed relay taps, time dial and instantaneous trip settings, transformer magnetizing inrush and ANSI transformer withstand parameters, cable thermal overcurrent withstand limits and significant symmetrical and asymmetrical fault currents. All restrictions of the National Electrical Code shall be adhered to and proper coordination intervals and separation of characteristic curves shall be maintained. The coordination plots for phase and ground protection devices shall be provided on a system basis. A sufficient number of separate curves shall be used to clearly indicate the coordination achieved.
4. The selection and settings of the protective devices shall be provided separately in a tabulated form listing circuit identification, IEEE device number, current transformer ratios and connection, manufacturer and type, range of adjustment and recommended settings. Any discrepancies, problem areas, or inadequacies shall be promptly brought to the Engineer's attention.

D STUDY REPORT

1. The results of the Power System Study shall be summarized in a final report. Submit six (6) bound copies of final report.
2. The report shall include the following sections:
   a. Description, purpose, basis and scope of the study and a single line diagram of that portion of the power system which is included within the scope of the study.
   b. Tabulations of circuit breakers, and other protective device ratings versus calculated short circuit duties, and commentary regarding same.
   c. Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip settings, and commentary regarding same.
   d. Fault current calculations including a definition of terms and guide for interpretation of computer printout.

PART 2 – NOT USED

PART 3 – EXECUTION

3.1 PROTECTIVE DEVICE TESTING, CALIBRATION AND ADJUSTMENT

A. The equipment manufacturer shall provide the services of a qualified field Engineer any necessary tools and equipment to test, calibrate and adjust the protective relays and circuit breaker trip devices as recommended in the Power System Study.

3.2 ARC FAULT LABELING

A. Contractor shall submit sample of arc fault label during shop drawing review for approval.

END OF SECTION

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SECTION 26 24 16
PANELBOARDS

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of panelboard load-center and enclosure work, including cabinets and cutout boxes, is indicated by drawings and schedules.

B. Types of panelboards and enclosures in this section include the following:

Lighting and Appliance Panelboards.

Distribution Panelboards.

Split Bus Panelboards.

Electronic Grade Panelboards

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's data including specifications, installation instructions and general recommendations, for each type of panelboard required. Include data substantiating that units comply with requirements.

B. Shop Drawings: Submit dimensioned drawings of panelboards and enclosures showing layouts of enclosures and required individual panelboard devices, including by not necessarily limited to, circuit breakers, contactors, and accessories, including wiring diagrams of contactors.

1.3 COORDINATION

A. The drawings are scheme and/or diagrammatic in nature, and indicate the need and intent of the design. These are to be used for general guidance only. It shall be the responsibility of the Electrical Contractor to coordinate, with other Division Subcontractors, the installation of all raceways, raceway supports, junction boxes and required fittings. This coordination will include conduit layout to allow access to equipment for maintenance.

B. This coordination shall be carried out prior to actual installation; this shall be done to eliminate the possibility of conflicts between trades on items such as access, clearances and maintenance issues that may arise after completion of construction.

C. Should the coordination not be carried out prior to installation, and a conflict exists, the installing contractor shall remove and reinstall the equipment as required to clear the conflict at no additional cost to the Owner and no delay in project completion.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products of one of the following (for each type of panelboard and enclosure):

Siemens (to match existing on site)

2.2 PANELBOARDS

A. General:

1. Panelboards shall comply with the following industry standards:

a. UL Listing/Approval

b. UL Standards:

Panelboards - UL67

Cabinet & Boxes - UL50

c. National Electric Code

d. NEMA Standard -PBI

2. Interiors:

a. All interiors shall be completely factory assembled. They shall be so designed that switching and protective devices can be replaced without disturbing adjacent units and without removing the main bus connectors, so that circuits may be changed without machining, drilling and tapping.

b. Branch circuits shall be arranged using double row construction. A nameplate shall be provided listing panel type and rating.

c. Unless otherwise noted, full size insulated neutral bars shall be included. Bus bar taps for panels with single pole branches shall be arranged for sequence phasing of the branch circuit devices. Neutral bussing shall have a suitable lug for each outgoing feeder requiring a neutral connection. A ground bus will be included in all panelboards.

3. Boxes: Boxes shall be a minimum 20 inches wide and manufactured from galvanized steel. Provide minimum gutter space in accordance with the National Electric Code.

4. Trim:

a. Switching device handles shall be accessible. Panel access doors shall not uncover any live parts. Doors shall have flush type cylinder lock and catch except doors over 48" in height shall have auxiliary fastenings top and bottom of door in addition to the flush type cylinder lock and catch. Panelboard trim clamps shall be of the indicating type. Upon removal of screws behind door, the panel interiors become service accessible via piano hinged trim front.

b. Panel access door hinges shall be concealed. All locks shall be keyed alike; directory frame shall be welded metal and having a transparent cover shall be furnished with each door.

c. All exterior and interior steel surfaces of the trim shall be properly cleaned, primed with a rust inhibiting phosphatized coating and finish with a gray ANSI 61 paint. Trims for flush panels shall overlap the box for a least 3/4 inch all around. Surface trims shall have the same width and height as the box. Trims shall be mountable by a screwdriver and without the need for special tools.

5. Main Bus and Branch Circuits: All main bus bars shall be full size aluminum, sized in accordance with U.L. standards to limit the temperature rise on any current carrying part to a maximum of 50 degrees C above an ambient of 40 degrees C maximum.

B. Distribution Panelboards:

1. Panels shall be provided with molded case circuit breakers tested and U.L. labeled per U.L. 489.

2. Circuit breakers 100 ampere through 400 ampere frame sizes shall be thermal-magnetic trip with inverse time current characteristics.

3. Where multiple pole circuit breakers are indicated, provide with common trip so overload on one pole will trip all poles simultaneously. Molded case circuit breakers shall have a minimum 22,000 symmetrical RMS interrupting capacity at 240 volts.

C. Lighting and Appliance Panelboards:

1. Provide switching and protective devices in quantities, ratings, types indicated, with anti-turn solderless pressure type lug connectors approved for copper conductors. Circuit breakers shall be the bolt-on, molded case, thermal magnetic type, with toggle handles that indicate when tripped. Where multiple pole circuit breakers are indicated, provide with common trip so overload on one

pole will trip all poles simultaneously.

2. Panelboards for use at 240 volts AC maximum shall incorporate circuit breakers as shown rated at 10,000 A.I.C. symmetrical at 240 volts.
3. Panelboards for use at 480/277 volts AC maximum shall incorporate circuit breakers as shown rated at 14,000 A.I.C. symmetrical at 480 volts.

D. Electronic Grade Panelboard: Furnish a dead-front safety type panelboard with the following:

1. 42 poles with size, type and number of circuit breakers as indicated on the floor plan.
2. Isolated ground bus.
3. 200% rated copper neutral bus.
4. Equipment ground bus.
5. Integral transient voltage surge suppressor.
6. High frequency extended range tracking filter and high-performance suppression system.
7. Full diagnostic test point.

E. TVSS Requirements:

1. TVSS shall be Listed in accordance with UL 1283 and 1449 Second Edition, including the highest fault current of Section 37.3. (UL Recognized for Integral.)
2. TVSS shall have a UL Listed Short Circuit Current Rating (SCCR), equal to or greater than the SCCR where connected, per NEC 2002, Article 285 (as noted on drawings). It shall not require the use of any upstream overcurrent protection to obtain said rating.
3. TVSS shall be marked, *Suitable for use on a Circuit Capable of Delivering Not More Than 65,000 rms symmetrical Amperes, 480 Volts Maximum.* This marking shall be equal to or greater than the available fault current and voltage of application.
4. TVSS suppression components shall have a maximum continuous operating voltage (MCOV) of not less than 115% of the nominal phase-to-neutral operating voltage.
5. TVSS Submittal information shall include UL 1449, 2nd Edition, Listing Classification Page, indicating per mode Suppressed Voltage Ratings and UL Listed SCCR, each model and voltage.
6. Panel extended TVSS shall be installed, UL Listed, and shipped from the TVSS equipment manufacturer's factory using a UL recognized component listing, or shall be installed by the contractor following field installation instructions for a UL Recognized TVSS in a panel extension, per the drawings.
7. TVSS shall provide surge current diversion paths for all modes of protection; L-N, L-G, N-G in WYE systems, and L-L, L-G in DELTA systems.
8. TVSS shall be modular in design for Distribution. Module(s) shall be fused with surge rated fuses and incorporate thermal cutout devices capable of preventing thermal runaway of internal suppression components.
9. TVSS shall be provided with 1 set of NO/NC dry contacts for connection with a facility management system, and provide an audible alarm for notification of reduced or lost protection. Device shall have LED indicators to indicate the status of protection on each phase and/or mode.
10. TVSS shall meet or exceed the following criteria:
    a. Minimum per phase (L-N + L-G) surge capacity shall be (as noted on drawings):
        (1) Distribution panels: 160kA – High Exposure 120kA – Medium/Low
        (2) Branch panels: 120kA – High Exposure 80kA – Medium/Low

b. UL 1449 Listed, and Recognized Component Suppressed Voltage Ratings shall not exceed the following:

VOLTAGE	L-N	L-G	N-G
208Y/120	400V	400V	400V
480Y/277	800V	800V	800V

11. TVSS shall have a minimum EMI/RFI filtering of -50dB at 100kHz.
12. TVSS shall be provided with 1 set of NO/NC dry contacts. (when specified)
13. TVSS shall be provided with surge counter, as noted on drawings. (when specified)
14. TVSS shall have a five-year warranty. Warranty shall be the responsibility of the electrical distribution equipment manufacturer and shall be supported by their respective field service division.

PART 3 – EXECUTION

3.1 INSTALLATION OF PANELBOARDS

A. Install panelboards and enclosures where indicated in contract documents and, in accordance with the equipment manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.

B. Anchor enclosures firmly to walls and structural surfaces, ensuring that they are permanently and mechanically secure.

C. Provide all required electrical and grounding connections within the panelboards and enclosures.

D. The Electrical Contractor shall furnish and install on the door within each enclosure, a circuit labeling identification system for all electrical panelboards. The system must satisfy the NEC Article No. 110-22. The directories shall be typed, NOT handwritten. Directories shall indicate room numbers as indicated on contract documents and room numbers as physically labeled in the field.

E. The Electrical Contractor shall provide directories compiled using a software program that is Windows compatible. Program shall handle multiple panels, calculate panel electrical loads from user supplied data, maintain a history of repairs and upgrades by circuit, and be capable of printing panel directories and summaries. Verify compatibility with Owner’s operating system.

F. Provide two discs to owner containing software and project panel directories and summaries.

END OF SECTION

SECTION 26 27 26
WIRING DEVICES

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. The extent of wiring device work is indicated by drawings, schedules and specifications. Wiring devices are defined as single discrete units of the electrical distribution system which are intended to carry but not utilize electric energy.

B. Types of electrical wiring devices in this section include the following:

Receptacles.

Switches.

Device plates.

Time Clocks

Contactors

Energy Control Devices

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's data on electrical wiring devices.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products of one of the following (for each type of wiring device):

Legrand Co.

Hubbell, Inc.

Leviton Mfg. Co.

Lutron Electronics Co., Inc.

Cooper Wiring Devices

Square D Co.

Eaton Corp.

Siemens

Tork

Grasslin

Paragon

Wattstopper

2.2 FABRICATED WIRING DEVICES

A. Provide factory fabricated wiring devices, in types, styles, colors, and electrical ratings for applications indicated and complying with NEMA Standards Pub. No. WD 1. Where types and grades are not indicated, provide proper selection as determined by Installer to fulfill wiring requirements, and complying with NEC and NEMA Standards for wiring devices. Color selection to be verified by Contractor with Architect/Engineer.

2.3 RECEPTACLES

A. All simplex receptacles shall be extra heavy duty, 20 amperes, 125 volts, 2 pole, 3 wire grounding,

with green hexagonal equipment ground screw, with metal plaster ears, side wiring, NEMA configuration 5-20R unless otherwise indicated. Hubbell Cat. #HBL5361 or approved substitute.

B. All duplex receptacles shall be extra heavy duty, 20 amperes, 125 volts, 2 pole, 3 wire grounding type with green hexagonal equipment ground screw, with metal plaster ears, side wiring, NEMA configuration 5-20R unless otherwise indicated. Hubbell Cat. #HBL5362, #HBL8300, or approved substitute, HBL5362TR, where tamperproof is indicated.

C. Special Purpose Receptacles: Provide polarized grounding type special purpose receptacles of the required amperage and voltage ratings, extra heavy duty. Device shall include a green hexagonal equipment ground screw.

D. All ground fault receptacles shall be extra heavy-duty duplex, tamper resistant, 20 amperes, 125 volts, 2 pole, 3 wire grounding type with green hexagonal equipment ground screw, integral ground fault circuit interrupter, UL rated Class A, Group 1, with metal plaster ears, side wiring, NEMA Configuration 5-20R, self-testing with red and green LED indicator lights. Device shall include solid state ground-fault sensing and signaling, with a 5 milliampere ground fault trip level, plus or minus 1 milliampere. Hubbell Cat. #GFR5362SG, or approved substitute.

1. Whether indicated or not on the floor plans, the Electrical Contractor shall furnish and install GFI protected devices in kitchen areas on countertops near sinks, water coolers, refrigerators, on rooftop equipment, on exterior walls; and as indicated by the N.E.C., it shall be the discretion of the Electrical Contractor to provide GFI receptacles or GFI circuit breaker. Receptacles protected by GFI circuit breakers shall be permanently labeled on the faceplate as GFCI.

E. All Isolated Ground Duplex Receptacles shall be extra heavy duty, 20 amperes, 125 volts, 2 pole, 3 wire isolated ground with metal plaster ears, isolated from ground circuit, side wiring, NEMA configuration 5-20R unless otherwise indicated. Devices shall be color coded with an orange face and black triangle to identify all isolated ground devices. Hubbell Cat. #IG5362, or approved substitute.

F. All surge protection receptacles shall be extra heavy-duty duplex, 20 amperes, 125 volts, 2 pole, 3 wire with built-in surge protection, metal plaster ears. Devices shall include efficient 3-level MOV protection for phase to neutral, phase to ground and neutral to ground. Devices shall also include diagnostic LED indicator light to be on continuously when protection is active, and shall flash on and off when protection circuit is deactivated due to excessive transients. Hubbell Cat. #HBL5362SA, or approved substitute. Devices to be red when fed from emergency power.

G. All isolated ground, surge protection receptacles shall be extra heavy-duty duplex, 20 amperes, 125 volts, 2 pole, 3 wire isolated ground with built-in surge protection with metal plaster ears isolated from ground circuit. Device shall include efficient 3-level MOV protection for phase to neutral, phase to ground and neutral to ground. Device shall also include diagnostic LED indicator light to be on continuously when protection is active, and shall flash on and off when protection circuit is deactivated due to excessive transients. Devices shall be blue with green dot and orange triangle, Hubbell Cat. #IG5362SA, or approved substitute.

1. Whether indicated or not on the floor plans, the Electrical Contractor shall furnish and install one (1) isolated ground, surge protective receptacle next to each data outlet and connect to isolated ground panelboard, unless directed otherwise.

2.4 SWITCHES

A. Toggle Switch: Provide extra heavy duty, industrial series flush toggle, 1 pole, 2 pole, 3-way, 4-way AC quiet switch rated 20 amperes @ 120/277 volts with green hexagonal equipment ground screw, metal plaster earls, and side wired screw terminals. Similar to Hubbell Series HBL Series or approved substitute.

B. Toggle Switch with Pilot Light: Provide extra heavy duty industrial series, flush toggle, single pole,

AC quiet switch rated 20 amperes @ 120 volts with green hexagonal equipment ground screw, metal plaster ears, side-wired screw terminals and 1/25 watts, 125 volt neon pilot light, designed to mount within a single gang outlet box. Similar to Hubbell HBL or approved substitute.

C. Three Position Switch: Provide extra heavy duty industrial series, flush toggle, single pole, three position, momentary contact, center position OFF, AC quiet switch rated 20 amperes @ 120/277 volts, with green hexagonal equipment ground screw, metal plaster ears, and side-wired screw terminals. Similar to Hubbell Series HBL or approved substitute.

D. Key Switch: Provide extra heavy duty, industrial, 1 pole, 2 pole, 3-way, 4-way barrel key locking switch rated at 20 AMPs @ 120/277 volts with green grounding screw, metal plaster ears and side wired screw terminals. The tumbler shall be a six-point cylinder type. All project keyed switches to be keyed alike. Similar to Hubbell 122*RKL series.

2.5 DEVICE PLATES

A. Provide switch and receptacle outlet wall plates for wiring devices, of types, sizes, and with ganging and cut outs required by the devices being installed. Construct with metal screws for securing plates to devices; screw heads colored to match finish of plates; plates colored to match wiring devices to which attached. Provide device plates possessing the following additional construction features: **Receptacle outlet plates to be permanently marked with panel designation and circuit number on back side of plate.**

1. Metal Plates to be stainless steel of non-corrosive and non-magnetic 302 alloy, .032" nominal thickness. Plates shall have brushed satin finish.
2. Non-Metallic Plates to be a thermoplastic, virtually indestructible, molded polycarbonate material offering resistance to impact, scratches, discoloration and be self-extinguishing. Plates shall have no-line smooth finish.

B. Weatherproof device plates shall have spring-hinged waterproof cap suitably configured for each application, including face plate gaskets and corrosion-resistant fasteners. Boxes and devices shall be recessed, weatherproof with smoke gray opaque in-use covers. Intermatic Cat. #WP1000(H)GRC.

C. Existing mechanical spaces where concealed work is impractical, such as masonry pr block walls. Provide 4” square boxes, surface mounted, with ½” deep surface mounted device plates consisting of same material for devices indicated on plans, whether single or double gang. Use of plaster flange and standard cover plate will not be acceptable.

2.6 CONTACTORS

A. Electrically Held Power Lighting Contactor: Shall be rated 30 to 200 AMPs for 2 thru 5-pole versions and 300 to 800 AMPs for 2 and 3 pole versions, as indicated on the Floor Plan. Contactor shall have factory wired control and clearly marked termination points, designed for mixed load ratings with a UL listed short-circuit rating up to 100,000 amperes. Contactor shall be housed in a NEMA Type I, general purpose enclosure and be similar to Square D Company, Type "S", Class 8903 or approved substitute.

B. Mechanically Held Power Lighting Contactor: Shall be rated 30 to 200 AMPs for 2 thru 5 pole versions and 300 to 800 AMPs for 2 and 3 pole versions, as indicated on the Floor Plan. Contactor shall have factory wired control with coil clearing contacts and clearly marked termination points, designed for mixed load ratings with a UL listed short-circuit rating up to 100,000 amperes. Contactor shall be housed in a NEMA Type I, general purpose enclosure and be similar to Square D Company, Type "S", Class 8903 or approved substitute.

C. Multiple Lighting Contactor: Shall be an electrically or Mechanically held device with 2 thru 12 poles rated 30 AMPs ballast and 20 AMPs tungsten, as indicated. Mechanically held contactor shall have factory wired control with coil clearing contacts and clearly marked termination points. Contactor

shall be housed in a NEMA Type I, general purpose enclosure and be similar to Square D Company Types "L" and "LX", Class 8903 or approved substitute.

D. General: All contactor control setups shall include all required interface relays needed to function with maintained or momentary contact switches, time clocks and photocell controls. Control circuits and coil voltages shall be 120 volts A.C. single phase. Where system voltage is 277/480 volts, a control power transformer shall be furnished and installed within the contactor enclosure. Transformer shall be sized to handle the contactor's coil load as well as all associated control devices.

2.7 ENERGY CONTROL DEVICES (Occupancy Sensors)

A. Line Voltage:

1. Combination wall switch and sensor shall be Dual Technology Passive Infrared and Ultrasonic, designed for single gang outlet box installation, with a coverage of 180° for a maximum of 400 square feet. Device shall be suitable for 120/277 dual voltage operation, and have vandal resistant, hard sensor lens. Device shall be similar to Sensor Switch Cat. No. WSD-PDT or Wattstopper DW-100 Series, DW-103 Series for multi-way, DW-200 for dual relay, DW-203 for multi-way dual relay, or approved substitute.

2. Ceiling sensor shall be Dual Technology Passive Infrared and Ultrasonic 360° coverage, 1200 square feet maximum. Self Contained Relay Device shall be suitable for 120/277 Dual Voltage operation. Device shall be similar to Sensor Switch Cat. No. CMR-PDT, Wattstopper DT-355 or approved substitute.

B. Low Voltage:

1. Ceiling mounted sensor shall be Dual Technology Passive Infrared and Ultrasonic with 360° coverage up to 2o feet. Device accepts 12 to 24 volt AC or DC. Device shall be similar to Sensor Switch Cat. No. CM-PDT or approved substitute.

2. Sensor power pack shall be a low voltage power supply with an input of either 120 volts or 277 volts AC and an output of 24 volts DC @ 150 mA. Device shall contain a 20 AMP isolated load control relay. When relay is used, power supply output shall be reduced to 24 volts DC @ 114 mA. Device shall be similar to Sensor Switch PP-20 or approved substitute.

C. Photocontrol

1. Provide epoxy conformal coated cadmium sulphide photocell with Lexan impact and vandal resistant enclosure. Dome and base to be ultrasonically welded. Photocell shall respond to the light spectrum near to that of a human eye. Housing shall mount to ½" conduit and have 180° swivel.

2. Photocell shall have on/off time delay, on at 1 to 5 FC, off at 3 to 15 FC. Tool free adjustment. Unit shall fail in the ON position.

3. Unit shall operate from -40°F to 140°F, with a minimum 5-year warranty.

4. Provide Tork 2001 series or approved equivalent.

PART 3 – EXECUTION

3.1 INSTALLATION OF WIRING AND CONTROL DEVICES

A. Install wiring devices as indicated, in compliance with manufacturer's written instructions, applicable requirements of NEC and NECA's "Standard of Installation", and in accordance with recognized industry practices to fulfill project requirements.

B. Coordinate with other work, including painting, electrical box and wiring work, as necessary to interface installation of wiring devices with other work.

C. Install wiring devices only in electrical boxes which are clean, free from building materials, dirt and debris.

D. Provide electrical connections for wiring and control devices.

E. Delay installation of all wiring and control devices until wiring work is completed.

F. Isolated Ground Receptacle Devices shall be connected to the system ground by way of an insulated ground conductor color coded green with a yellow stripe.

3.2 PROTECTION OF WALL PLATES AND RECEPTACLES

A. At time of Substantial Completion, replace those items which have been damaged, including those burned and scorched by faulty plugs.

3.3 GROUNDING

A. Provide electrically continuous, tight grounding connections for wiring and control devices.

3.4 TESTING AND COMMISSIONING

A. Prior to energizing circuitry, test wiring devices for electrical continuity and proper polarity connections. After energizing circuitry, test wiring devices to demonstrate compliance with requirements.

B. After energizing circuitry, the Electrical Contractor shall test and adjust all control devices to provide optimum operation and performance.

C. All areas where energy control devices are specified shall be verified for full coverage and accurate operation. If any area is determined by the Owner, Architect, or Engineer to have inadequate coverage or operation, Contractor shall provide additional energy control devices to remedy the coverage or operation issue. For bidding purposed, own 5 extra devices fully installed. After successful commissioning, uninstalled devices shall be handed over to the Owner for spare devices. Device types shall be as required for commissioning, or as selected by Owner for space devices as applicable.

END OF SECTION

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SECTION 26 28 16.13
ENCLOSED SWITCHES

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of motor and circuit disconnect switch work is indicated by drawings and schedules.

B. Types of motor and circuit disconnect switches in this section include the following:

Equipment disconnects.

Appliance disconnects.

Motor-circuit disconnects.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's data including specifications, installation instructions and general recommendations, for each type of motor and circuit disconnect switch required.

1.3 COORDINATION

A. The drawings are scheme and/or diagrammatic in nature, and indicate the need and intent of the design. These are to be used for general guidance only. It shall be the responsibility of the Electrical Contractor to coordinate, with other Division Subcontractors, the installation of all motor and circuit disconnect switches, supporting hardware, including wiring and conduit, to and from the equipment. This coordination will include conduit layout to allow access to equipment for maintenance.

B. This coordination shall be carried out prior to actual installation; this shall be done to eliminate the possibility of conflicts between trades on items such as access, clearances and maintenance issues that may arise after completion of construction.

C. Should the coordination not be carried out prior to installation, and a conflict exists, the installing contractor shall remove and reinstall the equipment as required to clear the conflict at no additional cost to the Owner and no delay in project completion.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide products of one of the following (for each type of switch):

Siemens (to match existing on site)

2.2 FABRICATED SWITCHES

A. Safety Switches: Safety switches shall be of sizes noted on the drawings, fusible or non-fusible and contained in a general purpose enclosure. All switches shall be type HD and have quick-make, quick-break operation. All switches shall be of proper horsepower rating as applicable and have dual interlocks designed to interlock the switch box door with the switch operating mechanism. Unit shall be provided with a suitable means of interlock release. An arrangement shall be provided for locking the operating handle in the "ON" or "OFF" position. Safety switches shall have the proper type metal enclosure, i.e., standard, weatherproof, etc., to suit their specific location as required by the National Electrical Code.

B. Fuses: Provide fuses for safety switches, as recommended by switch manufacturer, of classes, types and ratings needed to fulfill electrical requirements for service indicated.

C. When packaged rooftop equipment is furnished, the unit disconnect switch shall be furnished, mounted and wired by the installing contractor.

D. When rooftop exhaust fans rated less than 1/2 HP at 120 volts, single phase, are furnished, except utility sets, the unit disconnect switch shall be furnished, mounted and wired by the installing contractor.

PART 3 – EXECUTION

3.1 INSTALLATION OF MOTOR AND CIRCUIT DISCONNECT SWITCHES

A. Install motor and circuit disconnect switches where indicated, complying with manufacturer's written instructions, applicable requirements of NEC, NEMA, and NECA's "Standard of Installation", and in accordance with recognized industry practices to ensure that products fulfill requirements.

B. Install disconnect switches used with motor-driven appliances, and motors and controllers within sight of controller position unless otherwise indicated.

C. Provide electrical connections for motor and circuit disconnect switches.

END OF SECTION

SECTION 26 28 16.16
ENCLOSED CIRCUIT BREAKERS

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of overcurrent protective device work is indicated by drawing schedules and specifications.

B. Types of overcurrent protective devices in this section include the following:

1. Service entrance rated disconnect.
2. Molded case circuit breaker.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's data on overcurrent protective devices, including: voltages and current ratings, interrupting ratings, current limitations, internal inductive and non-inductive loads, time-current trip characteristic curves, and mounting requirements.

B. Shop Drawings: Submit layout drawings of overcurrent protective devices, showing spatial relationships of units to associated electrical equipment, and connections to electrical power supplies.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include the following:

1. Circuit-Breakers

   Siemens (to match existing on site)

2.2 CIRCUIT BREAKERS

A. Except as otherwise indicated, provide circuit breakers and ancillary components, of types, sizes, ratings and electrical characteristics indicated, which comply with manufacturer's standard design, materials, components, and construction in accordance with published product information, as required for a complete installation.

B. Service Entrance Rated Disconnect: The service disconnect device shall be a molded-case circuit breaker totally front accessible and front connectable. The circuit breaker shall be a three-pole device suitable for operation on a 480 volt, 60 Hertz system. Circuit breaker shall have 65,000 RMS symmetrical amperes interrupting rating and shall be UL approved for Service Entrance equipment.

C. Molded-Case Circuit Breakers: Provide factory assembled, molded-cased circuit breakers of frame size indicated; 120/208 volts, and 277/480 volts 60 Hertz, one, two, or three poles with a short circuit symmetrical ampere interrupting rating as indicated by the panel schedule and/or as shown by the single line riser diagram. Provide circuit breakers with permanent thermal instantaneous magnetic trips in each pole with ampere ratings as indicated. Construct with overcenter, trip-free, toggle type operating mechanisms with quick-make, quick- break action and positive handle trip indication. Construct devices for mounting and operating in any physical position and operating in an ambient temperature of 40 degrees C. Provide circuit breakers with mechanical screw type connector lugs, AL/CU rated.

PART 3 – EXECUTION

3.1 INSTALLATION OF OVERCURRENT PROTECTIVE DEVICES

A. Install overcurrent protective devices as indicated in contract documents, in accordance with the manufacturer's written instructions and with recognized industry practices to ensure that protective devices comply with requirements. Comply with NEC Standards for Installation of overcurrent protective devices.

B. Coordinate with other work, including electrical wiring work, as necessary to interface installation of overcurrent protective devices with other work.

C. Fasten circuit breakers without causing mechanical stresses, twisting or misalignment being exerted by clamps, supports, or cabling.

3.2 ADJUST AND CLEAN

A. Inspect circuit-breaker operating mechanisms for malfunctioning and, where necessary, adjust units for free mechanical movement.

3.3 FIELD QUALITY CONTROL

A. Prior to energization of overcurrent protective devices, test devices for continuity of circuitry and for short-circuits. Correct malfunctioning units, and then demonstrate compliance with requirements.

END OF SECTION

SECTION 26 29 00
LOW-VOLTAGE CONTROLLERS

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. Extent of motor starter work is indicated by drawings, schedules and specifications.

B. Refer to sections of other divisions of these specifications for driven equipment specified without motor starters. Motor starters for such equipment are the work of this section.

C. Types of motor starters in this section include the following:

Manual.

Magnetic Full Voltage, Non-Reversing.

Combination Disconnect Switch and Magnetic Starter.

Adjustable Frequency Drive (AFD)

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's data on motor starters and accessories.

1.3 COORDINATION

A. The drawings and details there upon are scheme and/or diagrammatic in nature, and indicate the need and intent of the design. These are to be used for general guidance only. It shall be the responsibility of the Electrical Contractor to coordinate with other Division subcontractors, the installation of all motor starters, the need for control devices including the wiring and conduit, to and from the device.

B. This coordination shall be carried out prior to actual installation. This shall be done to eliminate the possibility of conflicts between trades on items such as access, clearances and maintenance issues that may arise after completion of coordination.

C. During the coordination phase of the project, the Electrical Contractor shall consult with Division 1 thru 28 subcontractors with regard to base design equipment characteristics. Any differences from the electrical plans and specifications shall be considered a change. The trade's contractor making the change at no additional cost to the Owner or delay in project completion shall handle these additional costs.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products of one of the following (for each type and rating of motor starter):

Siemens (to match existing on site)

2.2 MOTOR STARTERS

A. Provide motor starters and ancillary components; of types, sizes, ratings and electrical characteristics indicated which comply with manufacturer's standard materials, design and construction in accordance with published product information, and as required for complete installations.

B. Fractional HP Manual Motor Starters: Provide manual, single phase, fractional HP motor starters for each motor rated less than 1/2 HP, of types, ratings and electrical characteristics indicated. Equip unit with thermal overload relay for protection of 120 volt AC motors. Provide starters with quick-make, quick-break, trip free toggle mechanisms, selector switches for hand-off-automatic control; mount starter in NEMA Type 1 or Type 4 enclosure as indicated or required by the NEC.

C. Magnetic Motor Starter: Provide magnetic full voltage, non-reversing starters for each motor rated 1/2 HP and more of types, ratings and electrical characteristics indicated; equip with solid state overload relays, control transformers with 120V secondary, with one secondary fuse and one grounded secondary lead, two normally open and two normally closed auxiliary contacts, hand-off- automatic selector switch, red and green pilot lights wired and mounted through front of the enclosure. Mount starter in NEMA Type 1 or Type 4 enclosure as required by the NEC.

D. Combination Disconnect Switch Magnetic Starter: Provide full-voltage, non-reversing, combination non-fused disconnect switch and magnetic starter for each motor rated 1/2 horsepower and more, of types, ratings and electrical characteristics indicated; equip with solid state overload relays, control transformer with 120 volt secondary, one secondary fuse and one grounded secondary lead, two normally open and two normally closed auxiliary contacts, hand-off- automatic switch, red and green pilot lights wired and mounted through the front of the enclosure. Mount starter in NEMA Type 1 or Type 4 enclosure as required by the National Electrical Code (NEC).

E. Three (3) phase, full voltage, non-reversing magnetic motor starters, horsepower rating with minimum NEMA size #0 shall be as follows:

NEMA Size	Continuous Rating	Maximum Horsepower	
		208 Volt	480 Volt
0	18 AMPs	3HP	5HP
1	27 AMPs	7-1/2HP	10HP
2	45 AMPs	10HP	25HP
3	90 AMPs	25HP	50HP
4	135 AMPs	40HP	100HP
5	270 AMPs	75HP	200HP

Motor full-load current shall not exceed continuous ampere rating of starter.

F. Adjustable Frequency Drive (AFD): The AFD shall convert the input AC main power to an adjustable frequency and voltage. The output frequency and voltage of the AFD shall be adjustable to maintain a constant voltage/hertz ratio throughout the operating range. The AFD shall be designed to operate from a 480 volt, three phase, 60 hertz main supply that is within +10% or -10% of nominal line voltage. The AFD control technique shall employ the pulse width modulated (PWM) technology.

1. Ratings:
   a. The AFD shall be capable of supplying 120% of rated full load current for one minute at maximum ambient temperature.
   b. Unit shall be rated for installation in a power system capable of delivering up to 65,000 RMS symmetrical amperes.
   c. Minimum power factor shall be .95 throughout the entire speed range.
   d. The AFD efficiency shall be 98% at full speed.
2. Adjustments:

a. The acceleration and deceleration ramp rates shall be adjustable from 1 to 60 seconds.

b. The overload trip shall be adjustable from 0 to 100% of rated output current.

c. The current limit shall be adjustable from 60 to 120% of rated output current to maximize starting torque.

d. Voltage boost shall be adjustable from 100 to 400% of nominal voltage/hertz ratio at 1 hertz tapering to 100% at 20 Hertz.

e. The drive shall provide a control for adjusting the minimum frequency setting up to 45 Hertz and a maximum operating frequency adjustable over a range of 40 to 60 Hertz.

3. Protection:

a. A non-adjustable instantaneous overcurrent trip shall be set to 250% of rated output current.

b. AFD protection shall be accomplished with fuseless electronic protective circuits, to protect from the following conditions:

- Short circuit at AFD output.
- Ground fault at AFD output.
- Open circuit at AFD output.
- Input undervoltage.
- DC bus overvoltage.
- Loss of input phase.
- AC line switching transients.
- Instantaneous overload.
- Sustained overload exceeding 100% of rated current.
- Overtemperature.

4. Control:

a. All the following operator controls shall be mounted to the front panel which is integral to the AFD:

- Manual speed potentiometer.
- Hand-Off-Auto (HOA) switch. The AFD shall accept an input signal of 4 to 20 Ma. DC. as an automatic speed reference signal when the AFD is in the automatic mode of operation. The manual speed potentiometer shall control the AFD when the switch is in the manual mode.
- The AFD shall be furnished with an isolated follower with a setpoint control of 4 to 20 Ma. DC with PI control from an isolated ground signal.

5. Operator Interface:

a. The AFD shall be furnished with an alphanumeric display and keypad to allow the operator access to drive modes, parameters and status conditions.

b. Operator control and setup functions shall include the following:

(1) Frequency setpoint

(2) Acceleration/Deceleration time

(3) Minimum/Maximum Output Frequencies

(4) Proportional Gain

(5) Integral Gain

(6) Setpoint

(7) Drive Reset

(8) Elapsed Time

(9) Enable PI (Setpoint) Control

(10) Auto Reference Source Select

Operating status information will consist of the following:

(1) Frequency Output

(2) Output Current

(3) Output Voltage

(4) Accel/Decel Ramp Time

(5) Forward/Reverse Direction

(6) Hand/Auto Local Indicator

(7) Elapsed Time

The diagnostic and fault conditions available via the operator interface will include the following:

(1) Output Frequency

(2) Output Current

(3) Output Voltage

(4) Shutdown Reference Status

(5) Jog Status

(6) Mode of Operation

(7) Input Signal Levels

(8) Faults

(9) Overload Timer Activated

(10) Motor Current Limit

6. Enclosure:

a. The enclosure shall be NEMA Type 1 with a dead front and back construction with all components and load, line and control terminations fully front accessible. The enclosure shall be self-ventilated and have provisions for top and bottom entry of conduit and wire.

PART 3 – EXECUTION

3.1 INSTALLATION OF MOTOR STARTERS

A. Install motor starters in accordance with manufacture's written instructions, applicable requirements of NEC, NEMA Standards, and NECA's "Standard of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.

B. The Electrical Contractor shall consult and cooperate with the Control Contractor in assisting him in making control connections to the automatic position of the selector switch and to the auxiliary contacts.

C. Motor Data: Before installing wiring for motors and starters, the Electrical Contractor shall consult the respective parties furnishing the equipment and obtain from them all data necessary to properly

connect the apparatus, and for selection of thermal overload relays in accordance with motor nameplate. Any variance in loads or electrical characteristics from the contract drawings should be reported to the Engineer before proceeding with the work.

D. When packaged equipment is furnished, all unit starters shall be furnished, mounted and wired by the installing contractor. The Electrical Contractor shall furnish and install a disconnect switch, as specified in Section 26 28 16.13, and wire between unit's main terminal block and the disconnect switch.

E. When packaged rooftop equipment is furnished, the unit disconnect switch and all starters shall be furnished, mounted and wired by the installing contractor. The Electrical Contractor shall wire between the line side of the disconnect switch and the building system.

F. Should the Electrical Contractor elect to furnish and install an electric alternator with magnetic starters in lieu of the duplex motor controller, he shall provide all control wiring needed to make the alternator and the starters function as a unit.

G. Provide connections for motor starters.

3.2 ADJUST AND CLEAN

A. Inspect operating mechanisms for malfunctioning and where necessary adjust units for free mechanical movement.

B. Touch-up scratched or marred surfaces to match original finish.

3.3 FIELD QUALITY CONTROL

A. Subsequent to wire/cable hookup, energize motor starters and demonstrate functioning of equipment in accordance with requirements.

END OF SECTION

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SECTION 26 50 00
LIGHTING

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. Lighting fixture work is indicated by specifications, drawings and schedules.

B. Types of lighting fixtures in this section include the following:

1. LED

C. Applications of lighting fixtures required for the project include the following:

1. General Lighting.
2. Supplementary Lighting.
3. Emergency Lighting.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's data on building lighting fixtures.

B. Shop Drawings: Submit dimensioned drawings of lighting fixture installations, including but not necessarily limited to, layout, relation to associated panelboards, and connections to panelboards. Submit fixture shop drawings in booklet form with separate sheet for each fixture, assembled in luminaire "type" alphabetical order, with proposed fixture and accessories clearly indicated on each sheet.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Each lighting fixture type specified represents a specific style and quality of fixture acceptable for this project.

B. The Engineer reserves the right to reject any shop drawing and to request a resubmission should the contractor submit a shop drawing of an equivalent manufacturer which is viewed as being of an incompatible style or inferior quality.

C. No fixture shop drawing shall be submitted, nor will any be accepted, for any manufacturer which is not specifically listed for that fixture type. When a fixture manufacturer is listed for a specific fixture type, this does not provide him with the right to submit for fixtures he is not listed under. A bidding Contractor may elect to bid using non-listed fixtures for the listed Lighting Representatives. The Engineer and the Architect shall make the final decision on whether the submitted fixture meets the project's requirements during shop drawing review.

D. Should the Contractor be unable to obtain approval of the resubmitted manufacturer, then he should submit the basis of design specified manufacturer/fixture.

2.2 LIGHTING FIXTURES

A. Provide lighting fixtures of the size, type and rating indicated complete with, but not necessarily limited to, housings, lamp holders, reflectors, ballast, lamps, mounting frames, pendants and wiring; wired and connected in place, complete, tested and left in satisfactory operating condition.

B. LED Drivers

1. All LED fixtures shall be provided with integral drivers (unless noted otherwise) and must operate at line voltage as indicated on drawings (unless noted otherwise).
2. LED drivers shall have operating temperature of 50°F - 140°F unless noted otherwise.
3. LED drivers shall carry a 5-year warranty.

E. Fixture Lamps: For the type, number and color of the fixture lamps, refer to the Lighting Fixture Schedule on the drawings.

PART 3 – EXECUTION

3.1 INSTALLATION OF LIGHTING FIXTURES

A. Install lighting fixtures at locations and heights as indicated, in accordance with fixture manufacturer's written instructions, applicable requirements of NEC, NECA's "Standard of Installation", NEMA Standards and with recognized industry practices to ensure that lighting fixtures fulfill requirements of the project.

B. Install lighting fixtures in removable tile ceilings using 3/8" flexible metal conduit with 3 # 12 awg. conductor. Maximum length of flexible lead shall not exceed 60". Flexible lead shall extend from the fixture to the junction box. The junction box shall be securely fastened to the building structure above the removable tile ceiling and shall not serve more than two (2) lighting fixtures, nor shall the junction box support any of the lighting fixtures.

3.2 LIGHTING FIXTURE MOUNTING

A. 1' x 4', 2' x 2' and 2' x 4' fixtures installed in a removable tile ceiling shall be installed using T-Bar grid safety clips as provided by the fixture manufacturer and as required by the NEC.

B. 2'x 2' and 2' x 4' fixtures installed in a removable tile ceiling shall be installed using support wires at all four corners of the fixture. The support wires shall be carried up to the building structure and securely anchored using screwed or bolted hardware. Pressure type clips will not be acceptable. The Electrical Contractor shall be responsible for installing or having installed these four (4) support wires.

C. 1' x 4' fixtures installed in a removable tile ceiling shall be installed using support wires at two (2) corners of the fixture. The support wires shall be carried up to the building structure and securely anchored using screwed or bolted hardware. Pressure type clips will not be acceptable. The Electrical Contractor shall be responsible for installing or having installed these Two (2) support wires.

D. Downlights installed in a removable tile ceiling shall be installed using 24" spreader bars attached to the T-Bar grid system. Two (2) support wires shall be installed, one (1) on each side of the fixture and centered between the spreader bars, these support wires shall be carried up to building structure and securely anchored using screwed or bolted hardware. Pressure type clips will not be acceptable. The Electrical Contractor shall be responsible for installing or having installed these two (2) support wires.

E. Pendant lighting fixtures, either chain, cable or stem hung below a removable tile ceiling shall be installed in accordance with fixture manufacturer's written instructions and recommendations. The Electrical Contractor shall furnish and install support wire or threaded rod from the fixture mounting hardware up to building structure and securely anchor using screwed or bolted hardware. Pressure type clips will not be acceptable. These support devices shall be independent from the ceiling T-Bar grid system, the system may be used as a guide, but in no way shall the T-Bar grid system carry any of the weight produced by the fixture or it's support devices.

F. Surface mounted fixtures installed on removable tile ceilings or dry wall ceilings shall be installed in accordance with fixture manufacturer's written instructions and recommendations.

1. Fixtures installed on removable tile ceilings shall be anchored to the T-Bar grid system using snap-on clips with threaded studs and wing nuts. The Electrical Contractor shall furnish and install a support wire from each snap-on clip carried up to building construction and securely anchor using screwed or bolted hardware.

2. Fixtures installed on dry wall ceilings shall be mounted using spring-loaded toggle bolts. The number and location of the anchors shall depend on the fixture manufacture's written

instructions and recommendations. It shall be the responsibility of the Electrical Contractor to follow these instructions and recommendations.

3.3 ADJUST and CLEAN

A. Clean lens, reflectors and interiors of all lighting fixtures of dirt and construction debris upon completion of installation.

B. Protect installed lighting fixtures from damage during the remainder of the construction period.

3.4 FIELD QUALITY CONTROL

A. Upon completion of the installation of the lighting fixtures, and after the building circuitry has been energized, apply electrical energy to demonstrate capability and compliance with project requirements. Where possible, correct malfunctioning units at the site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.

B. At the time of Substantial Completion, replace lamps in lighting fixtures which are observed to be noticeably dimmed after Contractor's use and testing, as judged by the Architect/Engineer. Furnish stock or replacement lamps amounting to 15% (but not less than one (1) lamp in each case) of each type and size used in each type of fixture. Deliver the replacement stock as directed to the Owner's storage area.

1. Refer to Division 1 sections for the replacement/restoration of lamps in lighting fixtures, where used for temporary lighting prior to the time of Substantial Completion.

C. Replace defective and burned out lamps for a period of one (1) year following the time of Substantial Completion.

3.5 GROUNDING

A. Provide tight equipment grounding connections for each lighting fixture installation, in accordance with fixture manufacturer's recommendations and the NEC's requirements.

END OF SECTION

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SECTION 26 55 61
THEATRICAL LIGHTING

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 specification Sections, apply to this section.

1.2 SUMMARY

A. The Electrical Contractors, as part of the work of this section, shall coordinate, receive, mount, connect, and place into operation all equipment. The electrical contractor shall furnish all conduit, wire, connectors, hardware, and other incidental items necessary for the complete and properly functioning lighting control and dimming system as described herein and shown on the plans.

B. This section includes the following:

1. General specification for a dimming and control system.
2. Specifications for four different control systems
3. specifications for three different dimmer systems
4. Installation and Checkout of equipment on job site.

1.3 MANUFACTURERS REQUIREMENTS

A. The equipment herein specified is manufactured by Leviton Lighting Controls Division, Tualatin Oregon (503)-404-5500 and shall serve to indicate the quality of equipment required. Base bid shall be for equipment by Leviton Lighting Controls Division. If alternate equipment is proposed, it shall be shown as an add or deduct from the base bid price and shall be subject to approval.

B. Other manufacturers who wish to bid must submit a complete bill of materials and company information listing qualifications and experience to the Architect ten days prior to bid date for permission to bid. All manufactures must comply with the specifications herein in every detail.

1.4 EQUIVALENT MANUFACTURERS

Strand

Lehigh

ETC

1.5 MANUFACTURERS SERVICES

A. Shop Drawings: Shop Drawings shall be submitted for approval within 30 days after receipt of contract. No fabrication of equipment is to proceed prior to approval of these drawings. Submittal package shall contain:

1. A complete bill of material
2. Sets of catalog cuts for standard equipment
3. Sets of shop drawings detailing all mechanical and electrical equipment including one line diagrams, wire counts, internal wiring, and physical dimensions of each item. Marked up catalog cuts are unacceptable.

B. Jobsite Checkout: Upon completion of all contractors wiring, and after all fixtures are installed and lamped, the contractor shall request the services of a factory representative to completely check out the system prior to energizing the system. At the time of checkout and testing, the

owner's representative shall be thoroughly instructed in the proper operation of the system for a full day.

C. Documentation: Two complete sets of as built drawings shall ship with the equipment when it leaves the factory, along with operations and maintenance manuals for the dimmer system.

D. Ballasts: It shall be the responsibility of the installing contractor to insure that any fluorescent dimming ballasts supplied are compatible with the dimming equipment being furnished on this project.

E. Installation Instructions: Installing contractor shall follow manufacturer's installation instructions

F. Operation and Maintenance Instructions. Within two weeks after system turn-on is completed, the manufacturer shall provide three sets operations and maintenance manuals along with a copy of written warranty.

1.6 QUALITY INSURANCE

A. Source Limitations: Obtain dimming controls from a single source with total responsibility for compatibility of lighting control system components specified in this Section.

B. Performance Testing Requirements

1. All equipment shall be 100% tested as a complete system. Sample testing is not acceptable.

C. Code Requirements

1. All system components shall be UL listed and so labeled when delivered to job site.
2. Building Codes: All specified dimmers and scene controllers shall comply with the National Electrical Code. All units shall also comply with applicable, local building codes.

D. Installer Qualifications: Installer shall be one who is experienced in performing the work of this section, and who has specialized in installation of work similar to that required for this project.

E. Source Limitations: To assure compatibility, obtain dimming systems and controls from a single source with complete responsibility over all lighting systems and controls, including accessory products.

F. Manufacturer Requirements

1. Experience: The manufacturer will be one who has been continuously engaged in the manufacture of architectural lighting controls and dimmers for no less than ten years.
2. Testing: Manufacturer shall assemble all dimmers into dimmer cabinets and complete all internal wiring at the factory, prior to shipment. Testing shall be done as a complete, powered system: all dimmers shall be simultaneously connected to load banks, and all control stations shall be connected to the dimmer cabinet(s). Testing shall include exercising all functions such as take control, transferring, mastering, fading, or other special control provisions for each control and control station included in the system.

1.7 DELIVERY, STORAGE & HANDLING

A. General: Comply with Division 1 Product Requirements Sections.

B. Ordering: Comply with manufacturer's ordering instructions and lead-time requirements to avoid construction delays.

C. Delivery: Materials must be delivered, in a timely manner to other trades.

D. Storage and Protection: Store materials away from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.

1.8 WARRANTY

A. Manufacturer's Warranty: All equipment shall be warranted free of defects in materials and workmanship.

B. Warranty Period: 26 months from date of shipment or two years from date of turn-on, whichever occurs first.

C. Owner Rights: Manufacturer's warranty is in addition to, not a limitation of, other rights the Owner may have under contract documents.

PART 2 – PRODUCTS

2.1 DIMMING SYSTEM

A. General Description:

1. The dimmer rack shall contain 48 dimmer module slots for housing up to 96 dimmers.
2. The rack shall offer an option for a redundant control module that provides seamless backup in case of the main control module's failure or removal from the rack.
3. Each dimmer module shall monitor the temperature parameters for each dimmer.

B. Dimmer Rack Mechanical

1. The rack is built from extruded aluminum structural members with removable side panels of code gauge steel, measuring 86" high x 17" wide x 24" deep.
2. All exterior surfaces shall be finished in textured black powder coat finish.
3. Side, rear, top and bottom panels shall be easily removed without dismantling the rack.
4. Since the racks require no rear or side access, racks shall be able to be mounted back-to-back or side-to-side.
5. The front of the rack shall be completely open, allowing clear installer access to all line, load and control terminations.
6. Dedicated wire guides shall be mounted internally to aid in installation of load circuit wiring. Each load termination shall accept up to a #2 AWG wire.
7. The cooling fan and its control unit shall be mounted in removable modular housings for easy cleaning and maintenance.
8. Each dimmer shall receive fresh air through the door-mounted electrostatic filter.
9. Each rack shall have a locking door.
10. All dimmers shall be housed in removable modules made of die cast aluminum.
11. Each module shall contain one or two circuit breakers, a solid-state power switching device (SSR), a dimmer control PCB assembly, and two filter chokes.
12. All electrical contacts shall feature self-aligning floating connectors to insure precise alignment of all connections.
13. Modules shall be keyed so that a module of higher ampacity cannot be inserted into a slot that is wired for a lower ampacity dimmer.
14. All dimmer modules shall be inserted and removed without the use of any tools.
15. The rack shall be designed to operate on voltages ranging from 90-135VAC (120V nominal) at 50/60 Hz.
16. Rack shall be for use with four-wire three-phase or single-phase power. Simple rack-to-rack bussing eliminates the need to run separate line feeds to each rack.

17. The rack shall be UL listed and C-UL listed (for Canadian applications) with a short-circuit current rating of 100,000 RMS amps symmetrical providing listed dimmer modules are installed and the racks are not modified.
18. Optional current-limiting fault-current fuses (Amp-Traps) shall be available for other 100, 000 short-circuit current applications.
19. In systems that require a ground wire per load circuit, an optional ground bus shall be installed inside the rack.
20. All bussing, and all line and load terminal shall be copper.

C. Control Module

1. Each rack shall contain an electronic backplane with all control wiring connections on removable screw terminals for easy control wiring.
2. The backplane shall also retain all rack configurations, analog scenes, and backup scenes or looks in non-volatile memory, so that when any new control module is inserted, it automatically comes on-line, fully functional within ten seconds without requiring any programming by the user.
3. Each rack shall require a single control module that connects to the rack's electronic backplane.
4. Control modules shall be inserted and removed without the use of any tools.
5. Multiple control module outputs shall automatically pile-on to each other in a "highest takes precedence" fashion.
6. Each control module shall have three LED's to indicate the presence of voltage on each power phase.
7. The control module shall also contain LED's for overtemp, active control sources, panic and diagnostics.
8. The rack configuration and all backup scenes shall be able to be accessed through Hand-Held Terminal plugged into the front of the module, or remotely.
9. The 120V control module shall be UL Listed and C-UL Listed.
10. Each control module has an opto-isolated DMX512 input, a twelve-scene analog input and a 99-scene backup input. The module combines all inputs in a "highest takes precedence" manner. Analog scenes include snapshot capability.
11. Each dimmer shall be able to be programmed for the following operating parameters:

    a) Minimum and maximum level

    b) Non-dim operation

    c) Softpatch
12. Feedback information shall appear through the LED's of each dimmer module.
13. Feedback information to the control module for each dimmer shall include overtemp warning.
14. In addition to feedback from each dimmer, the rack shall monitor and provide feedback for the active voltage per phase.
15. Each rack comes with hardware-selectable Panic operation.
16. Terminals for dry contact closures shall be provided to initiate a Panic scene which shall drive all selected dimmers without affecting any other control setting.

D. Dimmer Module

1. The dimmer module shall be designed for superior reliability in the most demanding of operating conditions.
2. Each dimmer module shall monitors it's temperature and report this information to the control module.
3. Each dimmer module shall have a dedicated optically isolated control signal line from the control module.
4. The failure of one module shall not affect the operation of any other dimmer module.
5. Mechanical:
   a. All dimmers shall be housed in removable modules made of die-cast aluminum.
   b. Each module shall contain one or two circuit breakers, a solid-state power switching device (SSR), a dimmer control PCB assembly, and two filter chokes.
   c. The face of the module shall have a handle, the circuit breaker switches, air vents, and labeled LEDs for local feedback.
   d. The left side of the module shall have a wide section of spring steel to insure a proper fit for each module in the rack.
   e. All electrical contacts shall feature self-aligning floating connectors to insure precise alignment of all connections.
   f. Modules shall be keyed so that a module of higher ampacity cannot be inserted into a slot that is wired for a lower ampacity dimmer.
   g. All dimmer modules shall be inserted and removed without the use of any tools.
6. Electrical:
   a. The dimmer module shall be designed to operate on voltages ranging from 90-135VAC (120V nominal) at 50/60 +/-1Hz.
   b. The load lugs in the rack shall be capable of accepting up to #2 AWG wire.
   c. The dimmer module electronics' firing signal shall be optically isolated to 4,000 Volts from the power semiconductors.
   d. The control signal from the control console shall be optically isolated from the control module electronics.
   e. The dimmer module shall be capable of withstanding the following adverse conditions without any interruption of operation:
      1) A complete dropout of line voltage for up to 10 milliseconds
      2) A line surge or sag of 25% of nominal operating voltage for at least 500 milliseconds
      3) Transient voltages up to 21/2 times the nominal line voltage
   f. The module shall also maintain proper output voltage regulation with +/- 1 Volt for line voltage changes of up to 10% per second, and for line frequency changes of up to 1 Hertz per second.
   g. Each dimmer shall be able to be programmed for the following operating parameters:
      1) Soft patch
      2) Minimum and maximum level
      3) Non-dim operation

h. When a dimmer is set as a non-dim, it shall pass a full sine wave unregulated from the input voltage.

i. Each dimmer shall track overtemp and level conditions, and provides feedback to the LEDs on the face of the dimmer module.

j. Real-time feedback information to the control module for each dimmer shall include:

1) Over-temperature warning

2) Over-temperature shutdown.

k. Modules shall be available in standard (500microsecond) rise times. (350 microseconds for dual 5kW, 230V) measured from 10% to 90% at 90 degrees conduction angle under full load. Oscillographic evidence of rise time data shall be provided before approval of any alternated manufacturer is allowed.

l. Airflow modules shall be required in unused slots in order to maintain proper rack ventilation.

m. 120V units shall be UL listed and C-UL listed (for Canadian applications).

n. Dimensions:

	H	W	D
Dual & Single Modules	11/2” 3.8cm	121/2” 31.8cm	61/2” 16.5cm

o. i Series e Dimmer Modules Rise Time and Maximum Heat Loss Per Channel

Catalog#	Description	Rise Time (in Microseconds)	Current Rating	Watts	Max Heat Loss Per Channel BTU/hr	Ton/AC
4-0011E	i500 1.8KW 120V Dual Dimmer Module	500	2 x 15A	70	239	.020
4-0012E	i500 2.4KW 120V Dual Dimmer Module	500	2 x 20A	93	317	.027
4-0014E	i500 6.0KW 120V Single Dimmer Module	500	50A	264	900	.076
4-0061E	i500 2.5KW 230V Dual Dimmer Module	500	2 x 15A	119	406	.034
4-0052E	i350 5.0KW 230V Dual Dimmer Module	350	2 x 25A	96	327	.028
4-0064E	i500 5.0KW 230V Single Dimmer Module	500	25A	224	764	.064
4-0031	i Series 15Amp 120V Constant Module		2 x 20A			

Provide the following:

Qty.	Catalog No.	Description
1	4-0112E	i96e Rack: 120V Standard Dual 1.8/2.4 kW
1	4-0112E	i96e Rack to contain 400A/3P enclosed circuit breaker/60A/2P furnished and installed by E.C.
1	4-0311E	Control Module 120V
48	4-0012E	i500e 2.4KW Dual Dimmer Module
23	4-0099	Filler Modules
1	40001-00	i96e Rack Ground Bus Kit

2.2 DIMMING SYSTEM OVERVIEW

A. The Dimension 8000 system shall be a lighting control system designed specifically for the control of architectural lighting. Large networks of wall stations can be assembled using Multiple Protocol Converters (“input/output nodes”), which are capable of utilizing several data

transmission methods depending on the application. The network shall offer Lumanet III and Ethernet protocols as a minimum.

B. Multiple Protocol Converters ("input/output nodes) may be self-contained within the dimmer system or may be external devices that shall interface to the dimmer system though DMX-512. Multiple DMX I/O nodes may be provided for system redundancy where specified.

C. The system architecture shall be based on a peer-to-peer network, where the failure of any single component or node shall not cause loss of other system functions. Systems that require a central processor for system operation are not acceptable.

D. Systems shall be grouped in up to 128 station nodes to form a "subnetwork". Multiple Protocol Converters ("input/output nodes") can be used to join subnetworks together. Networks can contain both daisy chained and/or starred wiring configurations.

E. Each subnetwork shall use 2 or 3 pair RS-485 cable with maximum overall length of 5000 ft.

F. Each subnetwork shall use LUMANET III as the primary protocol.

G. Each node on a subnetwork shall have a unique logical identifier ("ID") numbered from 0 to 255.

E. Each subnetwork shall control a maximum of 2048 dimmer channels.

F. Wall stations may have up to 255 unique lighting control programs ("Personalities").

G. Station nodes may be linked to other station nodes on the same or different subnetwork. Linkages may be changed at any time by any other station or I/O node capable of transmitting the necessary LUMANET III commands.

H. Combine and Separate of adjoining rooms shall be accomplished by linking stations and/or through use of station personalities.

I. Ethernet protocol shall be ColorNet 2.0 (or later revision), TCP/IP based protocol. Protocol shall conform to and be fully compatible with all 10/100 BaseT TCP/IP routers and networks.

2.3 WALL STATIONS (Station Nodes)

A. Each Wall Station shall contain its own microprocessor, a LUMANET III connection, re-programmable flash memory for storage of operating program, and additional non-volatile memory for storage of lighting control programming data.

B. All station nodes shall be capable of having both the internal operating program updated and the lighting control program modified though the LUMANET network, utilizing an appropriate input/output node. Mechanical removal of the station from the installation location shall not be necessary. Systems that require removal of stations for updating the operating system or programming data are not acceptable.

C. All stations shall be capable of storing up to 255 unique sets of lighting control programming (Personalities).

D. Any station shall be capable of becoming a slave to any other identical station.

E. All buttons shall be captured mechanically to prevent inadvertent removal of button caps.

F. Presets may include any assigned dimmers even though those dimmers are assigned to other presets on the same or other Stations.

G. All stations shall have the ability to assign one of eight function security levels to any of the functions. The lowest security level shall be zero (any access). Seven shall be the highest security level. The station shall also have eight overall security modes. The function security level shall be required to be a lower number than the station security mode before the function can execute. A station security mode of eight will allow all function access. A station security mode of zero will not allow any function access. Station security mode may be set by

keyswitch, remote device, or by local password (LCD station only). Systems that allow only one security level, or do not allow security levels for various functions within a station are not acceptable.

H. LCD Wall Station:

1. Station shall have a faceplate made of DuPont Corian™. A defined selection of standard colors is available. Additional DuPont Corian™ colors are available as custom.
2. Exposed station dimensions shall be 4-1/2”Hx8-7/16”Wx1/2”D. Station shall mount in standard 4-gang back box (min dimension 2-13/16”Hx8-1/8”Wx3”D).
3. Station shall contain a long life (50,000 hours min.) backlit LCD display. Electro Luminescent Displays are not acceptable. LCD shall be 20 characters by 4 lines. LCD shall display text as programmed. Text shall be unique to network selected station Personality (menu). LCD may also be used for local programming prompts.
4. The station shall contain 15 momentary push buttons. Buttons shall be selectively backlit by LED’s. Buttons shall operate in momentary or toggle modes. Pressing a button shall cause a pre-programmed lighting control command to be transmitted on the subnetwork.
5. Station shall allow local manual adjustment of assigned dimmer levels for each preset, utilizing the LCD display and pushbuttons. This feature shall be capable of being electronically locked out.
6. The Station shall allow the presets to optionally capture and store the current levels of assigned dimmers (SNAPSHOT), even though the dimmer levels originated from another station, control console, or other external source. Systems with LCD Stations that do not support snapshot function to its presets from multiple sources are not acceptable.
7. The LCD station shall be capable of storing up to 7 passwords. A station security mode from 1 to 7 shall be assigned to each password
8. The LCD station shall prompt for a password whenever a function is selected that has a security level that is higher or the same of the station security mode
9. The LCD Station shall have the option to automatically return to a preprogrammed personality (menu) and/or security mode in a preprogrammed time after station is idle
10. The LCD Station shall have selectable backlight level for active/idle conditions. The selections shall be: High/High, High/Low, and High/Off.

I. Pushbutton Wall Station:

1. Station shall have a faceplate made of DuPont Corian™. A defined selection of standard colors is available. Additional DuPont Corian™ colors are available as custom.
2. Exposed station dimensions shall be 4-1/2”Hx3”Wx1/2”D. Station shall mount in standard 1-gang back box (min dimension 2-3/4”Hx1-3/4”Wx2”D).
3. Station shall contain from 1 to 15 momentary push buttons. Buttons shall be selectively backlit by LED’s. Buttons shall operate in momentary or toggle modes. Pressing a button shall cause a pre-programmed lighting control command to be transmitted on the subnetwork.

J. Provide the Following:

Stage Manager Panel

Quantity 1 000-KLCDO-00B LCD Station

Panic Switch

Quantity 4 000-KB010-00W

Entry Stations (2-Button)

Quantity 3 000-KB022-00W

Manufacturer to Program Eight Preset Names on LCD Control

Preset 1 House

Preset 2 Hse/Stge

Preset 3 Assembly

Preset 4 Study

Preset 5 Band

Preset 6 Choir

Preset 7 A/V

Preset 8 Drama

K. Distribution Equipment

1. Pipe Battens

   a. All stage battens shall be 1-1/2” nominal diameter schedule 40 pipe with lengths as described above. All joints shall be sleeve spliced with 18” long sleeves with 9” extending into each pipe held by two (2) 3/8” hex bolts and lock nuts on each side of joint.

   b. All battens are to be hung level and plumb, and are to be supported by 3/8” all-thread and associated accessories, in conjunction with standard practices and manufacturer’s written instructions. This is to include any assemblies or additional supports as may be needed to provide adequate support.

   c. All electrics shall be a double pipe batten with connector strip supports for the second pipe batten.

   d. Front of house shall be a single pipe batten with connector strip and terminal box mounted above. Electrical Contractor shall steel flex connect from terminal box to above ceiling junction box and transition to conduit to dimmer board. Electrical Contractor shall be responsible to paint all hardware and flex conduit to match surrounding area.

2. Connector Strips

   a. Each section shall consist of a 4" x 4" (102mm x 102mm) 18 gauge steel wireway or extruded aluminum with removable cover sections for access, labeled with circuit numbers.

   b. Each strip shall have a terminal compartment which shall be factory installed on the right of left end as required and shall contain molded barrier type terminals for feed connection.

   c. The strip shall be provided with heavy steel mounting straps on approximately 5' (1.52m) centers, to grip up to 2" (51mm) pipe.

   d. Type S or SO, 18" (457mm) cable pigtails shall be secured by strain reliefs and shall be furnished with three pole grounded female receptacles. Flush receptacles are available in lieu of pigtails. Internal wiring shall be rated at 125 C.

   e. External finish shall be black powder coat epoxy. The entire unit shall be UL and CSA approved and labeled.

Provide the following:

Qty.	Catalog No.	Description

Connector Strip with locking Connectors

First, Second and Third Electrics

3	157-000	30’ Long connector strip with nine (9) 20 AMP twist locking connectors mounted on 18” pigtails and wired on six (6) circuits. Provided complete with terminal box, mounting straps, circuit labels and wire mesh.

Front of House:

1	157-000	25’ long connector strip with nine (6) 20A twist lock connectors mounted on 18” pigtails and wired on nine (6) circuits. Provided complete with terminal box, mounting strips, circuit labels.

Connector Strip Accessories

Qty.	Catalog No.	Description
4	152-045	Wire mesh grip, large with loop 12/28 & 10/24 and larger cables

Note: #12 AWG and #10AWG multi-conductor cable drops to be specified per project requirements. Specify quantity, gauge, length of drops, and number of conductors required per drop. Include one ground conductor in each drop.

3. Gridiron Boxes
   a. Each unit shall be a surface mounted code gauge steel box located as shown on the drawings. The unit shall be provided with terminal strips for feed connections. Knockouts, cables clamps and "Kellums" cable grips shall be provided. Access shall be by means of a removable cover.
   b. Finish shall be black baked enamel and the entire unit shall be UL listed and CSA approved in Canada.

Provide the following:

Qty.	Catalog No.	Description
4	175-003	Gridiron Box, 14-21 circuits

K. Fixtures:

1. Border Lights: Electrical Contractor shall furnish and install border lights for 1st and 2nd electrics as indicated on plans and as mentioned above as part of base bid. Wiring to be installed and terminated at connector strip.
   a. Housing shall consist of die cast aluminum end plates, extruded aluminum rails secured to a code gauge steel housing with compartment dividers. All painted surfaces shall be baked high temperature black. Rated 600 volts, 660 watts continuous operation. Rated lamp seal temperatures shall not be exceeded.
   b. Unit shall be provided with leads at each end of the unit consisting of three(four) 3-wire, 600V, 200oC, UL listed conductors, 18" long in a silicone braided sleeve. Male and female connectors shall be provided as specified by catalog number.
   c. For mounting, unit shall be provided with a heavy steel trunion securely fastened to each of the cast steel end plates and equipped with painted malleable iron C-clamps, adjustable for up to 2" ID pipe ("U" bolts not acceptable). Each unit shall be provided with a tilt adjust knob. Optional castered carriage sets with trunions shall be provided

for CVC lighting applications.

Provide the Following:

Qty.	Catalog No.	Description
12	216-046	4' Borderlight 1 circuits with Locking Connectors. Colorado batten 72 tour LED RGBWA
24	138-059	Safety cables
24		1-1/2” Conduit clamps. Removeable

Provide all required 5 pin DMX cables to each fixture and to dimmer board.

2. Front of House Lights, Torms, and Ladder Truss: Electrical Contractor shall furnish and install six (6) spot lights as indicated on plans and as mentioned below as part of base bid.
   a. Ellipsoidal Spotlights

      Provide:

      3 Etc. color source CE spot LED RGB-L, DMX XLR5, 26°

      3 Etc. color source CE spot LED RGB-L, DMX XLR5, 36°

      6 1-1/2” removeable conduit clamps.

      Provide all required 5 pin DMX cables to each fixture and to dimmer board.

   b. Par Spotlights

      Provide:

      15 Etc. color source PAR, LED RGB-L, DMX XLR5

      15 1-1/2” removeable conduit clamps.

      Provide all required 5 pin DMX cables to each fixture and to dimmer board.

3. Follow Spot: Provide (1) Follow spot kit with case of type Robert Juliat “Buxie” 575W fixture. Provide (3) spare lamps. Provide 25’ #10 heavy duty extension cord. Yellow in color, Turn unit over to Owner.

2.4 CONTROL CONSOLE (24/48)

A. General:

1. The control console shall be a microprocessor based lighting control system specifically designed and constructed for the control of theatrical and television dimming systems. The control console shall provide for the control of up to 1536 dimmers on a maximum of 384 control channels, a maximum 500 cues, and a maximum 512 automated device traits. Output shall be USITT standard (DMX-512), A super VGA color monitor with a minimum of 800 by 600 lines of resolution with a 0.28mm dot pitch shall be supplied as an option.
2. The operating program shall be stored in an internal non-volatile read-only memory. Off-line show data storage shall be accomplished with a high density 3 1/2" floppy disk drive. Operating program updates shall be available from the manufacturer’s web site at no additional charge.
3. The console shall provide two modes of operation: two-scene preset operation and multiscene memory operation. In two-scene preset mode, the console shall provide two scenes of 24 control channels each. In multiscene memory mode, the console shall combine the two-scene channel fader controls into one scene of 512 control channels. Selection of the operating mode shall be accomplished in the Set Up display

B. Physical

1. The lighting control console shall be a freestanding table assembly with a separate video monitor. The console shall be no larger than 6" high x 15.5" deep x 46." long with a weight of 48 lbs.
2. The console shall be made of heavy-gauge sheet metal finished in a black with white and teal silkscreen graphics.
3. The console shall have a user-replaceable high voltage protection module that will protect the processor engine from any accidental high voltage entering via the control data line.
4. The video monitor shall be a high resolution super VGA monitor with a minimum of 600 by 800 lines of resolution and 0.28 mm dot pitch. The monitor shall be switchable to use either 90 to 132V AC or 180 to 264V AC.
5. The LCD display mounted on the surface of the console shall offer a minimum 256 x 64 pixels. The physical size of this display shall not be less than 1.2” high x 4.7” wide. Consoles not offering both video and LCD displays shall not be considered equal and thus shall not be acceptable.
6. The power supply shall be dual voltage, capable of 85V to 135V or 185 to 250V AC 50 - 60 Hz.
7. The console shall provide at least two (2) switched convenience outlets for providing power to the monitor and any peripheral devices.

C. Mechanical – The lighting control console shall provide, but not be limited to, he following features:

1. Grand Master to provide a master level for all operational functions.
2. A Black-out switch.
3. Airflow LED indicating a loss of proper airflow.
4. Two scenes of 24 channel potentiometers for two-scene preset operation.
5. 24 individually-programmed, fully overlapping pile-on submasters or effect masters with 8 pages for a total of 192 submasters.
6. 96 Bump buttons for momentary control of channels.
7. Two independent crossfaders to provide a split dipless fade between Scene A and Scene B, and Scene C and D.

The Memory section shall have the following controls:

1. A group of eight (8) keys for calling up various displays on the monitor. The displays shall allow level setting, previewing, and modification of show data.
2. Expanded numeric keypad used to enter information regarding cue levels, cue timing, cue attributes, groups, submasters, effects, profiles, patching, and set-up. Keys shall also be provided for recording cues, groups, intelligent devices, and submasters live from the stage display.
3. A cursor position keypad with directional arrow keys.
4. A set of 8 “soft” function keys for access of up to 8 different functions in each display or sub display. These keys may change function in each display to focus the operator’s attention on commands which are useful in that display and to reduce congestion of the control surface.
5. Eight (8) macro keys for operator access to up to 2000 operator-programmable macros.
6. A trackball for adjusting channel levels proportionally, video cursor movements, and edits.
7. Seven (7) wheels with integrated LCD for adjusting intelligent device traits.

8. Two Rate keys for assigning live rate control of a selected effect or cue fade to a wheel.
9. Two Load keys for loading cues to playback faders.
10. Two GO buttons for initiating fades between cues in the normal numerically sequential order. The GO button shall provide positive tactile feedback to the operator to confirm its operation.
11. Two HOLD keys for stopping currently running fades, and two BACK keys for initiating fades backwards through the normal cue sequence.
12. Four (4) 100mm Playback Faders grouped as two pairs for manual control of cue fades.
13. All channel faders submasters, and bump buttons operational in two-scene mode shall also be operational in multiscene mode.

D. Operational

1. Displays: The console shall provide the following displays that can be selected by the operator to appear on the monitor at any time:
   a. Stage shall allow viewing of live channel levels (that appear on the stage), whether they come from cue levels, submasters, effects, or manual control. All channel levels may be viewed simultaneously. Cue fader status, current stage cue and parameters and tracking mode also shall be indicated in the stage display.
   b. Preview shall allow blind viewing and editing of cues in memory. the operator shall be able to specify an exclusive list of channels to be shown in the display at any time. The current stage cue and parameters and tracking mode also shall be indicated.
   c. Cuesheet shall be a numerically sequential list of all cues and their timing parameters. The Cuesheet display also shall indicate effects, profiles, links, macros, follows, and cleanup status assigned to cues.
   d. Tracksheet shall be a spreadsheet matrix of cues and channel levels. Up to 32 cues or cue parts by 24 channels may be viewed at one time. The operator shall be able to specify an exclusive list of channels to be shown in the display at any time. The display shall automatically page, centering on the selected preview cue.
   e. Playback is a non-editable cue sheet display, also showing playback fader status and submaster levels. The submaster levels section may be compressed to show only which submasters are active, and thereby show more cue sheet information.
   f. Patch shall allow viewing and editing of dimmer-to-channel assignments, and proportional dimmer delimiting (patch at level). The Patch display shall also indicate dimmer profile assignments, virtual non-dim assignments, and parked dimmer status. Patch information shall be selectable in the following formats: by Channel, by Dimmer, Non-dim Dimmers, and Parked Dimmers.
   g. Device shall show the status of five (5) intelligent devices at a time.
   h. Setup allows configuration of the console and selection of peripheral operations. The Setup display shall indicate the following information
2. Each display shall have the following elements:

   a command line showing command strings prior to their entry.

   a command history showing the last command entered.

   a selection of up to eight soft key functions.

3. Channel levels shall be displayed in different colors to indicate their source of status. Different colors shall indicate levels from cues, submasters, or effects.

   To optimize the use of the display area two different modes of text display shall be available for the operator to choose from. 25 lines per screen or 50 lines per screen. Consoles which do not provide expanded display area shall provide a second CRT.

4. Two-Scene Preset Operation: Fading between scenes shall be accomplished with the split crossfaders. Each crossfader may be assigned a separate fade time of up to 999.9 seconds, or may be operated manually in real time.

5. Multiscene Operation: Channel levels for channels 1 to 96 may be affected at any time by either the individual channel faders or by the keypad. If a channel level has been set by the keyboard, manual control shall be regained by matching the current level with the channel/fader ("match & grab" operation). Channels 97-144 are addressable by the keypad.

E. Cues

1. Cues and cue parameters may be recorded in any order. Up to nine (9) cues may be inserted between numerically consecutive cues.

2. Each cue may have up to eight (8) separate parts.

3. A cue may be assigned split times for channel levels that increase and decrease.

4. Each cue or cue part may be assigned the following parameters (all times may be set in 0.1 second increments):

   fade and delay times.

   split fade and split delay times.

   manual fades.

   effects.

   Any effect assigned to a cue shall have its channel levels fade up (or down) in the cue fade time while the effect is running. Consoles which do not fade effects within cues are not considered equal and are not acceptable.

   links to cues out of sequence.

   link repetitions.

   When a link causes a loop, the number of repetitions of the loop may be specified.

   return to normal sequence.

   A return to the next cue in sequence may be specified after a linked execution of a cue out of numerical sequence.

   cue profiles.

   These shall be selectable from the list of sixteen (16) operator-defined profiles.

   macros.

   Any macro assigned to a cue shall execute when that cue is triggered.

   cleanup designation.

   A cue designated as a cleanup cue shall prevent any levels from tracking into subsequent cues.

   cue name.

   alphanumeric names may be assigned to cues.

cue parameters (time, part, delay, profile, link, etc.) shall be accepted in any order when entered on the command line.

groups.

Any group may be assigned to a cue. When a group which is part of a cue is modified, the cue is likewise modified.

5. Cues may be recorded as tracking or not tracking, based on the tracking mode in effect at the time of recording. Three tracking modes shall be available: Tracking, Cue Only, and Cleanup. Cleanup mode shall prevent any kind of tracking whatsoever, and no zero levels shall be displayed while in Cleanup mode. Consoles which do not provide for user-defined cue recording modes are not considered equal and are not acceptable.
6. Cues, groups, and submasters may be recorded from any display, resulting in the recording of levels that are currently active on stage. Cues, groups, and effects may be created in the blind displays by selecting them by number within the preview display. Any editing done in the blind displays shall affect memory immediately without necessarily affecting stage levels (no use of the record keys is necessary). Consoles which require manual recording or recording in only limited displays are not equal and are not acceptable.

F. Groups: Any or all channels may be recorded at specific levels as a group. The console shall be able to record at least 500 different groups.

G. Submasters

1. Submasters shall operate in a Pile-on (highest level takes precedence), Inhibitive, or Effect mode. Visual indication of individual submaster modes shall be shown in the playback display.
   a. Normal mode: channel levels under control of the submaster handle.
   b. Inhibitive mode: Channels assigned to an inhibitive submaster shall have live stage levels output to dimmers only if the submaster is set above zero (the channel levels are proportionally “inhibited” by the current level setting of the submaster).
   c. Effect mode: any effect shall be assignable to the selected submaster, operating proportionally at its current level setting.
2. Each submaster shall have a memory of its channel level assignments for the pile-on mode. When modes are changed, the submaster will retain the level settings for the pile-on/normal mode. Up to 8 pages of submaster memory shall be provided. Consoles which do not provide for individually programmable submasters, and do not offer 8 pages of submasters or at least 192 total submasters are not considered equal and are not acceptable.
3. Each bump button shall be able to be assigned independently to a combination of the following operating modes: momentery, solo, toggle or off. For convenience, the operator shall have the option of assigning the mode of all bump buttons in one command.
4. A fade up and fade down time shall be programmable to each submaster. When the bump button is pressed, the submaster or effect will fade up. It will then fade down when the button is released in the momentary mode, or when it is pressed a second time in the toggle mode. The default shall be a time of 0 for instantaneous bump button control.

H. Effects

1. 600 different special effects may be recorded; they shall consist of a series of steps which repeat, forward or reverse, in any combination of the following patterns (positive or negative): alternate, bounce, build, and random. Any of a pool of 1000 steps may be assigned to each effect. A step can be built using a cue, group sub, channel list or combination of any

of the above. A different dwell time and active and inactive levels may be assigned to each step. The dwell time shall be able to be set in 0.1 second increments.

2. Effects shall be designated to operate, in cues or submasters, in pile-on and take-control with device traits. An effect may be assigned to fade up in a cue so that the effect shall continue to run through a series of cues. The effect shall continue unchanged until it is designated to fade down in a subsequent cue. While an effect assigned to a cue is running, additional effects may be faded up in subsequent cues to run simultaneously. All running effects may then be faded out individually or simultaneously. Consoles which require effects to be assigned to a separate fader or submaster or do not fade in and out as part of a cue are not considered equal and are not acceptable.

I. Tracksheet:

1. The Tracksheet display shall allow level setting and restoration or prevention of tracking to recorded cues. The display shall indicate to the operator which levels are tracking and which are not.
2. Any changes made to levels in the tracksheet shall affect tracking levels according to the currently selected tracking mode.

J. Patch

1. An electronic soft patch shall be provided for assigning control of the dimmers to specified channels.
2. It shall be possible to assign to each dimmer the following:

   a proportional maximum output level when its patched control channel is at full.

   a profile defining its output curve.

   a status of "park" at a designated level.

   a status of virtual non-dim. The trigger point shall be definable.
3. Channels may be assigned a device trait for controlling automated devices. This separates the channel from the main stage display.
4. It shall be possible to group like traits of automated devices into one control channel

K. Trackball Operation

1. Any channel list may be selected for control by the trackball. All channel levels under control of the trackball may be adjusted proportionally even after some have reached full or zero. Systems not offering trackball control shall not be considered equal and are not acceptable

L. Command Line Syntax

1. The operator shall be able to use any combination of the following items for constructing channel lists: channels, groups, submasters, effects, or cues. These lists may be created using the "and", "thru", and "minus" commands.
2. When recording cues, the cue parameters shall be accepted in any order on the command line. When editing cue parameters, it shall not be necessary to specify the currently selected (default) cue or cue part.

M. Miscellaneous Operation

1. Channel. levels shall operate on a “highest level takes precedence” or “last action takes precedence” basis whether the levels originate from channel faders, cues, submasters, or effects.

2. A "Release" command shall be provided to release captured channel levels to their settings prior to their capture.
3. A facility shall be provided for completing a "dimmer check".

   Naming: The following items can be assigned alpha-numeric names:

   show files

   cues

   groups

   subs

   effects

   devices

   profiles

   Each name can have up to 16 characters. Names can be used to recall items if desired. Naming shall be accomplished through keys that are integral to the standard console. In addition it shall be possible to enter names via PC compatible keyboard. Consoles that require separate keyboards are not equal and not acceptable.

N. Real Time Clock: It shall be possible to trigger up to 500 events using the built in real time clock. Systems not offering real time clock shall not be acceptable.

O. MIDI Interface: A system of MIDI Show Control Commands, general MIDI commands and MIDI Output commands shall be included. MIDI "in, out and through" receptacles shall be provided. Consoles that offer MIDI support software as an option shall include it to be considered equal.

P. Macros

1. For convenience, the operator shall have the option of recording of up to two thousand (2000) different macros.
2. It shall be possible to view all macros.
3. The macros shall be grouped into pages of eight (8) macros each, with the current page indicated in every display.
4. Up to 8 macros may be accessed remotely by contact closures.

Q. DMX Input

1. It shall be possible for the console to receive DMX signals. The console shall allow for two modes of use of the DMX input.
2. DMX signals may be merged.
3. A Nine (9) channel range may be used to select scenes and patterns

R. Setup

Setup shall provide as a minimum the following:

- Selectable dimmer protocols: Colortran digital signal (CMX) and the USITT standard (DMX-512), (AMX optional).
- A set of diagnostic programs to check the functioning of the internal electronics, the top panel controls, and the selected peripherals.
- Full printing functions which print current channel formats as specified by the operator.
- The ability to view and manage multiple show files on a single floppy disk.

- Commands to selectively retrieve specific show information from a floppy disk with the ability to renumber items and add them to the existing console memory. Consoles that will load only entire shows are not equal and not acceptable
- The ability to selectively clear cues, groups, effects, submasters, macros, patch, profiles, defaults, or the entire system from the console memory. Consoles that do not provide for selective clearing are not equal and not acceptable.
- An indication of the number of cues, groups, and effects that remain available in memory.

The ability to format 3½" High Density disks. Standard Pre-formatted (IBM PS/2 or compatible) disks may be used without console formatting. Consoles that require formatting of all disks or do not use a standard disk format are not acceptable. Setup shall provide a means for assigning devices and editing device definitions

S. Software Upgrades: Upgrades to the operating software of the console shall be able to be achieved by end user directly from a USB Drive. Consoles that require the physical replacement of PROMS or other memory devices, or that require site visits by a technician or return of the console to the factory for program upgrading are not acceptable.

T. Options: The following items shall be available as options:

A second local monitor video card.

Gooseneck worklights. Up to (3) supported.

A Hand Held Remote with recording and playback capabilities.

A ink jet or laser jet printer.

High Resolution VGA remote video supplied through the ColorNet system.

Remote Macro switch interface.

U. Warranty

1. A complete two (2) year warranty covering all parts and labor shall be provided for the control console and its peripheral devices. All software updates to the console released during the warranty period of the console shall be available to the owner free of charge.
2. It shall be required of the owner that a warranty registration card be completed and sent to the manufacturer in order to validate the warranty.

Provide The Following:

Qty.	Catalog No.	Description
1	7-0096	Colortran Innovator 24/48 Control Console
1	31388-00	Second Video Card
2	7-5052	Console Worklight
2	7-2091	Video Monitor, Color
1	7-5062	Innovator 24/48 Dust Cover
2	7-5101	Monitor Dustcover
1	7-5067	Innovator 24/48 Touring Case
2	7-5091	Monitor Touring Case
2	7-3014	25’ DMX Control Cable
4	7-4011	Flush Control In Connection Wall Plate (Furnish and installed as part of base bid)(single gang back box by others)

3. Refer to Floor Plans for additional control devices and fixtures.

PART 3 – EXECUTION

3.1 LOCATION

A. Site Verification: Verify that wiring conditions, which have been previously installed under other sections or at a previous time, are acceptable for product installation in accordance with manufacturer's instructions.

B. Field Measurements: The electrical contractor shall be responsible for field measurements and coordinating the physical size of all equipment with the architectural requirements of the spaces into which they are to be installed.

C. Inspection: Inspect all material included in this contract prior to installation. Manufacturer shall be notified of unacceptable material prior to installation.

3.2 INSTALLATION

A. The Electrical Contractor, as part of the work of this section, shall coordinate, receive, mount, connect, and place into operation all equipment. The Electrical Contractor shall furnish all conduit, wire, connectors, hardware, and other incidental items necessary for properly functioning lighting control and dimming as described herein and shown on the plans. The Electrical Contractor shall maintain performance criteria stated by manufacturer without defects, damage, or failure.

B. Compliance: Contractor shall comply with manufacturer's product data, including shop drawings, technical bulletins, product catalog installation instructions, and product carton instructions for installation.

C. Circuit Testing: The contractor shall test that all branch load circuits are operational before connecting loads to dimmer system load terminals, and then de-energize all circuits before installation.

D. Application of Power: Power shall not be applied to the dimming system during construction and prior to turn-on unless specifically authorized by written instructions from the manufacturer.

E. Electrical Contractor shall be responsible to fill out the panel schedules that are part of the shop drawings to which fixtures are on what dimmer. These schedules shall be typed and copied into each Owner's Manual and installed on back of door in each dimmer.

3.3 DEMONSTRATION

A. Lighting Control Systems: Upon completion of the work, the Stage Lighting Contractor shall submit three (3) copies of a detailed Operating and Maintenance Manual including as-built shop drawings, equipment descriptions and parts lists. The Stage Lighting Contractor shall go through the manual with Owner-designated personnel to demonstrate and explain the maintenance and operation of the systems.

B. Installing Contractor shall provide Owner with eight (8) hours of training on equipment. This contract shall include videotaping of session and video tapes of instructions on the use of the equipment.

3.4 TESTING

A. Notification: Upon completion of the installation, the contractor shall notify the dimming system manufacturer that the system is available for formal checkout. Notification shall be given in writing a minimum of 18 days prior to the time factory-trained personnel are required on site. Manufacturer shall have the option to waive formal turn-on.

B. Turn-On: Upon completion of all line, load and interconnection wiring, and after all fixtures are installed and lamped, Manufacturer's Rep or, if waived, Contractor shall completely check the installation prior to energizing the system. Each installed dimmer system shall be tested for each level of brightness, proper ON/OFF operations, and proper LED illumination. Each installed control panel shall be tested with each scene: verifying that each dimmer-controlled fixture adjusts to the selected scene and that all scene-controller LED's illuminate properly. If hand-held remote-control scene controller is specified and furnished, all operations shall be similarly tested.

C. At the time of checkout and testing, the owner's representative shall be thoroughly instructed in the proper operation of the system.

3.5 PROTECTION AND CLEANING

A. Protect all equipment after installation from damage during construction. If despite such protection, damage occurs, remove and replace damaged components or entire unit as required to restore units to their original, undamaged condition.

END OF SECTION

SECTION 26 60 00
ELEVATOR ELECTRICAL SYSTEMS

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. Elevator electrical work is indicated by drawings, schedules and specifications.

B. The feeder circuits, branch circuits and fire alarm interface shall include, but not be limited to, furnishing and installing a complete wire and conduit system with required equipment and components. This shall occur between the building's distribution panelboard, branch circuit panelboard, the fire alarm control panel and the elevator equipment, machine room, hoistway and elevator lobby.

C. Types of equipment to be furnished and installed in this section shall include, but not be limited to, the following:

1. Lighting (branch circuits)
2. Power (feeder circuits)
3. Control (fire alarm system)
4. Signal (telephone system) (when required)

PART 2 – PRODUCTS

2.1 LIGHTING

A. Furnish and install within the elevator machine room on strike side of machine room door, a 30-amp, 2 pole fused disconnect switch with conduit and wire to a junction box in the hoistway, final location of junction box shall be as directed by the elevator contractor.

B. The fused disconnect switch shall be connected to the local branch circuit panelboard with 2 # 12 + 1 # 12 ground in ¾" conduit. This circuit shall be used to provide service to the elevator car lighting, exhaust fan and any other small loads required by the elevator equipment.

2.2 POWER

A. Furnish and install within the elevator machine room on strike side of machine room door, fused disconnect switch (Refer to drawings for size) with auxiliary contacts, with conduit and wire to the elevator controller, refer to the single line diagram for conduit and wire size. Fuse type and size shall be as directed by the elevator manufacturer. The auxiliary contacts shall be used to disconnect the control panel's battery backup during maintenance.

B. Furnish and install within the distribution panelboard a 3-pole molded case circuit breaker with a shunt trip device, auxiliary contact and conduit and wire to the elevator disconnect switch. Refer to the single line diagram for the circuit breaker size and type and the conduit and wire size. The auxiliary contacts shall be used to disconnect the control panel's battery backup.

C. Furnish and install a 20 amp, 120 volt, single phase power source for the molded case circuit breaker's shunt trip device from a local branch circuit panelboard.

2.3 CONTROL

A. Furnish and install smoke detectors within areas of the building associated with the elevator as follows:

1. Elevator Lobbies one on each level

2. Hoistway at the top of the shaft. In addition to the smoke detector, furnish and install a heat detector (when the building is sprinkled).

3. Machine Room in addition to the smoke detector, furnish and install a heat detector (when the building is sprinkled).

B. Each elevator lobby, hoistway and machine room smoke detector shall be zoned separately from each other and from the floor detectors. These detectors shall be wired and programmed to form a three (3) circuit control scheme for elevator recall as outlined in the National Fire Alarm Code 3-8.14.6.

C. When the building is sprinkled the elevator machine room and the elevator hoistway shall have a heat detector installed. This detector shall be installed within 2 feet of the sprinkler head in accordance with the National Fire Alarm Code 3-8.15.2. The heat detector shall be furnished based on the Response Time Index (RTI) of both the heat detector and the sprinkler head. This detector shall be wired to the fire alarm control panel to provide for elevator shutdown in accordance with the National Fire Alarm Code 3-8.15.

D. Furnish and install a shunt trip device and auxiliary contact with power source on the elevator molded circuit breaker located in the distribution panelboard. When the building is sprinkled this device shall be wired to the fire alarm control panel in accordance with ANSI/ASME A17.1 – 1996, Rule 102.2 (C) and National Electrical Code 620-51.

2.4 COMMUNICATIONS

A. Furnish and install a four (4) pair, Cat 6 cable in ¾" conduit between the telephone terminal backboard and a junction box located in the elevator hoistway. Final location of the junction box shall be as directed by the elevator contractor.

PART 3 – EXECUTION

3.1 INSTALLATION OF ELEVATOR ELECTRICAL SYSTEMS

A. Install equipment and components, complying with equipment manufacturer's written instructions, applicable requirements of the National Electrical Code (NEC), NEMA and NECA's "Standard of Installation", and in accordance with recognized industry practices.

3.2 CONTROL WIRING

A. The Electrical Contractor shall furnish and install all required wiring between the fire alarm control panel and the elevator controller to provide for elevator recall when the building has an alarm condition. This contractor shall consult and cooperate with the elevator installing contractor.

B. The Electrical Contractor shall furnish and install all required wiring between the fire alarm control panel and the smoke detectors in the elevator lobbies, and the smoke and heat detectors in the elevator machine room and hoistway. This contractor shall consult and cooperate with the fire alarm manufacturer in providing the required programming and wiring needed to complete the recall system as required by the Elevator Code, NEC, NFPA and the NATIONAL FIRE ALARM CODE.

C. The Electrical Contractor shall furnish and install all required wiring between the fire alarm control panel and the shunt trip circuit breaker located in the distribution panel. This wiring and programming shall provide for the trip signal from the fire alarm control panel and a supervisory signal to the fire alarm control panel as "TROUBLE" for the loss of the trip power source. This wiring and programming shall be in accordance with the requirements of the NEC and the

NATIONAL FIRE ALARM CODE.

3.3 POWER WIRING

A. The Electrical Contractor shall furnish and install an elevator circuit breaker in the distribution panel of the size and type as indicated on the single line diagram. This circuit breaker shall be complete with a shunt trip device rated 120-volt A.C and auxiliary contact. The shunt trip device shall be wired to an external 120-volt power source in a local branch circuit panel with a 20 amp – 1 pole circuit breaker and 2 # 12 + 1 # 12 ground in ¾" conduit. Trip control and supervisory shall be furnished and installed as indicated above under 3.1 paragraph "C".

B. The Electrical Contractor shall furnish and install within the elevator machine room a fused elevator disconnect switch of the size and type indicated on the single line diagram. This disconnect switch shall be furnished with an auxiliary contact and wired to the elevator controller's "optional" battery system for disconnect and shutdown. If the "optional" battery system is not selected then the auxiliary contact remains un-wired. All required wiring shall be in accordance with the requirements of the NEC and the ELEVATOR CODE. The Electrical Contractor shall consult and cooperate with the elevator installer in providing this function.

C. The Electrical Contractor shall furnish and install a 30 amp,1 pole fused disconnect switch within the elevator machine room. This switch shall provide power to the elevator car lighting and exhaust system, the switch shall be connected to the elevator equipment in accordance with the elevator contractor's requirements. The switch shall be connected to a local branch circuit panel with a 20 amp – 1 pole circuit breaker and 2 # 12 + 1 # 12 ground in ¾" conduit.

3.4 COMMUNICATION WIRING

A. The Electrical Contractor shall furnish and install one (1) four pair, CAT6 cable in ¾" conduit between the elevator equipment and the building's telephone system. The Electrical Contractor shall consult and cooperate with the Elevator Contractor in making this connection.

END OF SECTION

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SECTION 26 80 00
WIRELESS CLOCK SYSTEMS

PART 1 – GENERAL

1.1 SECTION INCLUDES:

A. Transmission Systems

1. G.P.S. Receiver
2. Primary Transmitter
3. Wireless Tone Generator

B. Clocks

1. Analog

1.2 RELATED SECTIONS

A. Division 26 – Electrical (120-volt grounded outlet required for transmitter)

1.3 REFERENCES

A. This Technical Specification and Associated Drawings

B. National Fire Protection Agency (NFPA) – 70, National Electric Code 2002.

C. Primex Wireless GPS Satellite Time System User Manual.

1.4 DEFINITIONS

A. GPS: Global Positioning System, a worldwide system that employs 24 satellites in an integrated network to determine geographic location anywhere in the world, and which employs and transmits atomic time, the most accurate and reliable time.

1.5 SYSTEM DESCRIPTION

A. GPS wireless clock system shall continually synchronize clocks throughout the facility, and shall be capable of clock readouts in multiple time zones where desired.

B. The system shall synchronize all clocks to each other. The system shall utilize GPS technology to provide atomic time. The system shall not require hard wiring. Clocks shall automatically adjust for Daylight Savings Time.

C. Analog Clocks shall be synchronized to within 10 milliseconds 6 times per day, and the system shall have an internal oscillator that maintains plus or minus one second per day between synchronizations, so that clock accuracy shall not exceed plus or minus 0.2 seconds.

D. The system shall include an internal clock reference so that failure of the GPS signal shall not cause the clocks to fail in indicating time.

E. The system shall incorporate a “fail-safe” design so that failure of any component shall not cause failure of the system. Upon restoration of power or repair of failed component, the system shall resume normal operation without the need to reset the system or any component thereof.

F. Clock locations shall be as indicated, and clocks shall be fully portable, capable of being relocated at any time.

1.6 REGULATORY REQUIREMENTS

A. Equipment and components furnished shall be of manufacturer’s latest model.

B. Transmitter and receiver shall comply with Part 90 of FCC rules, as follows:

1. This device may not cause harmful interference, and

2. This device must accept interference received, including interference that may cause undesired operation.
3. Transmitter frequency shall be governed by FCC Part 90.35.
4. Transmitter output power shall be governed by FCC Part 90.257 (b).

C. System shall be installed in compliance with local and state authorities having jurisdiction.

1.7 SUBMITTALS

A. Product Data: Submit complete catalog data for each component, describing physical characteristics and method of installation. Submit brochure showing available colors and finishes of clocks.

B. Operating License: Submit evidence of application for operating license prior to installing equipment. Furnish the license, or if the license has not been received, a copy of the application for the license, to the Owner prior to operating the equipment. When license is received, deliver original license to Owner.

C. Samples: Submit one clock for approval. Approved sample shall be tagged and shall be installed in the work at location directed.

D. Manufacturer's Instructions: Submit complete installation, set-up and maintenance instructions.

1.7 SUBSTITUTIONS

A. Proposed substitutions, to be considered, shall be manufactured of equivalent materials that meet or exceed specified requirements of this Section.

B. Proposed substitutions shall be identified not less than 10 days prior to bid date.

C. Other systems requiring wiring and/or conduit between master and clocks, or which require connection of clocks to external electrical power supply will not be acceptable.

1.8 QUALITY ASSURANCE

A. Permits: Obtain operating license for the transmitter from the FCC.

B. Qualifications:

1. Manufacturer: Company specializing in manufacturing commercial time systems with a minimum of 10 continuous years of documented experience.
2. Installer: Company with documented experience in the installation of commercial time systems.

1.9 DELIVERY STORAGE AND HANDLING

A. Deliver all components to the site in the manufacturer's original packaging. Packaging shall contain manufacturer's name and address, product identification number, and other related information.

B. Store equipment in finished building, unopened containers until ready for installation.

1.10 PROJECT SITE CONDITIONS

A. Clocks shall not be installed until painting and other finish work in each room is complete.

B. Coordinate installation of GPS receiver for access to the roof or exterior side wall so that the bracket and related fasteners are watertight.

1.11 SYSTEM STARTUP

A. At completion of installation and prior to final acceptance, turn on the equipment; ensure that all equipment is operating properly, and that all clocks are functioning.

PART 2 – PRODUCTS

2.1 MANUFACTURER

A. GPS wireless clock system shall be manufactured by Primex Wireless, Inc., N3211 County Road H, Lake Geneva WI 53147 (800) 537-0464 FAX (262) 248-0061 www.primexwireless.com.

2.2 SEQUENCE OF OPERATION

A. Transmitter Operation: When power is first applied to the transmitter, it checks for and displays the software version. It then checks the position of the switches and stores their position in memory. The transmitter looks for the GPS time signal. Once the transmitter has received the GPS time, it sets its internal clock to that time. The transmitter then starts to transmit its internal time once every second. The transmitter updates its internal clock every time it receives valid time data from the GPS.

B. Analog Clock Operation:

1. Insert batteries in clock and follow set up procedures detailed in manufacturer's instructions.
2. After initial setup, the clock will shut off the receiver. Six times each day, the microprocessor will activate the receiver and starting with the stored channel, it will again look for a valid time signal. If necessary, the clocks will resynchronize to the correct time.
3. If the clock has not decoded a valid time signal a pre-determined number of days, it will go to a step mode. Non-signal reception can be caused by low battery voltage. If this occurs, replace the batteries.

C. WT Operation: When the WT generator receives a signal from the transmitter, it shall generate a tone to actuate the devices that have been predetermined to operate upon receipt of that tone.

2.3 EQUIPMENT

A. General: The clock system shall include a transmitter, a roof or window mounted GPS receiver, indicating clocks, and all accessories for complete operation.

B. GPS Receiver: GPS roof mounted, with 15-foot cable attached (additional Primex Wireless extension cable available: 100 foot).

1. The GPS Receiver shall be a complete GPS receiver including antenna in a waterproof case, 3-7/8 inches by 4-3/16 inches by 2 inches, designed for roof or outdoor mounting. Provide mounting bracket for attachment to roof structure.

C. Transmitter: Primex Wireless **Model 14400**, consisting of wireless transmitter with GPS receiver, a surge suppressor/battery backup, and a mounting shelf. Unit shall obtain current atomic time from satellite. The clock system shall transmit time continuously to all clocks in the system.

1. Transmission:
   a. Frequency Range: 72.100 to 72.400 MHz.
   b. Transmission Range: one mile, open field.
   c. Radio technology: narrowband FM
   d. Number of channels: 16
   e. Channel bandwidth: 20 kHz maximum
   f. Transition mode: one-way communication
   g. Data rate: 2 KBps
   h. Operating range: 0 degrees C. to 70 degrees C.
2. Transmitter:

a. Transmitter output power: +26 to +30 dBm
b. Frequency deviation: +/- 4 kHz
c. Transmitter power requirements: 120 VAC 60 Hz
d. Internal power requirements: 5 VDC
e. Carrier frequency stability: +/- 20 ppm

3. Transmitter shall have 16 selectable channels to assure interference-free reception.
4. Transmitter shall have the following switches:
   a. Time zone adjustment switches for all time zones in the world. Includes all US time zones: Eastern, Central, Mountain, Pacific, Alaska and Hawaii.
   b. Daylight Saving Time bypass switch.
   c. 12-hour or 24-hour display.
5. Transmitter housing shall be black metal case, 16-3/4 inches by 12 inches by 1-7/8 inches in size.
6. Antenna shall be 46 inches high, commercial type, mounted on top center of transmitter housing. Antenna gain shall be < 2.2 dB. Antenna polarization shall be vertical.
7. Transmitter housing shall incorporate a display which shall include the following:
   a. Time readout
   b. AM and PM indicator if 12-hour time display is set
   c. Day and date readout
   d. Indicator for daylight savings or standard time
   e. LED which shall flash red in event of reception problem
   f. GPS reception indicator
8. Transmitter shall contain an internal clock such that failure of reception from the GPS will not disable the operation of the clocks.

D. Power supply (included)

Input: 120 volt AC 50/60 Hz, 0.4 amp.

Output: 9 volt DC, 1.5 amp.

E. Surge Protector/Battery Backup (included).

Input: 120 volt AC 60 Hz +/- 1 Hz.

Output: 120 volt AC, 500VA, 300 watts

Surge Energy Rating: 365 joules

F. Additional Equipment

1. Wireless Receiver Switches: Switches shall receive time packets from the Master Transmitter and relay the synchronized time to the Satellite Transmitter connected to it. The unit shall include the following:
   a. Antenna mounted on top of the switch housing, 11-1/2 inches long.
   b. Power Supply:

      Input 120 VAC 50/60 Hz, 0.4 amps

      Output: 9 volt DC, 1.5 amps
   c. RS 232 data cable, 5 feet long

d. Daylight Savings Time bypass switch

e. Dimensions: 4-1/4 inches long, 5/-3/4 inches wide, 1-1/4 inches deep.

f. Weight: 12 ounces

g. Operating Range: 32 degrees F to 158 degrees F
(0-70 degrees C)

G. Traditional analog clocks: Primex Wireless analog clocks, 12-1/2 inch diameter, Primex Model **14155** for Classrooms and Offices, **or** 16 inch diameter, Primex Wireless Model **14157** for the Gymnasium**.** Analog clocks shall be wall mounted. Clocks shall have polycarbonate frame and polycarbonate lens. Face shall be white. Hour and minute hands shall be black. Analog clocks shall be provided with red sweep second hand.

1. Analog clocks shall be battery-operated, and shall have 5-year battery life.
2. Analog clocks shall be capable of automatically adjusting for Daylight Saving Time. An on-off switch located on the transmitter shall disable this function if desired.
3. Time shall be automatically updated from the transmitter 6 times per day.
4. Analog clocks shall remember the time during changing of batteries.
5. 9 inch and 12.5 inch analog clocks shall have a tamper proof/theft resistant clock lock mounting slots.
6. Provide two alkaline batteries. (9 inch – C cells, 12.5 and 16 inch – D cells)
7. Analog clock receivers shall be as follows:
   a. Receiver sensitivity: >-110 dBm
   b. Receiver power: two alkaline D-cells
   c. Antenna type: internal
   d. Antenna gain: -7 dBd
8. If transmitter stops transmitting valid time signals due to power failure, the clocks will continue to function as accurate quartz clocks until a valid time signal is decoded.

H. Wire guards: Provide one for each analog clock as follows:

1. Model No. **14123**, 18 by 18 inch size, for 16 inch diameter analog clocks in Gymnasium.

I. Cable Connection Sealant: Radio Shack Coaxial Cable Connector Sealant 278-1645, or approved electrical grade silicone sealant.

J. Wireless Tone Generator:

1. Primex Wireless Model 14002, WT generator, complete with cables and antenna required for complete installation.
2. Size: Approximately 7-1/4 inches wide by 5 inches long by 1-1/2 inches high, not including antenna.
3. Generator shall be housed in a black plastic case.
4. 9 volt switching power supply (fed from 120 volt line)
5. Switching contacts "Form D", two sets: one normally open, one normally closed.
6. Switch ratings:
   a. Contact ratings:
      4.4 amp, 1/6 hp, 125v, 250v, AC
      4.4 amp, 20 volts DC

b. DC Break ratings:

30 watt maximum

One amp, 30 volts, DC; 24 amp, 125 volts DC

7. Audio Output:
   a. Isolation transformer with center tap, 600/150 ohms output impedance
   b. Variable output and line level
8. Relay output
9. Test and reset buttons
10. Signal indicator
11. One hundred switch identification codes. Any number of switches for each identification code.
12. Selectable channels: 16
13. 24 programmable events with 7 day selectable operations.
14. Selectable options for each event, as follows:
    a. None
    b. Turn on 5 seconds
    c. Turn on and stay on
    d. Turn off and stay off
    e. Turn on 2 seconds, off 1 second, on 2 seconds
    f. Turn on 3 seconds
    g. Turn on 1 second then off 1 second (repeat 5 times)
    h. Turn on 3 seconds, off 3 minutes, on 3 seconds, off 2 minutes, on 3 seconds
    i. Turn on 3 seconds, off 4 minutes, on 3 seconds, off 1 minute, on 3 seconds
    j. Turn on 3 seconds, off 5 minutes, on 3 seconds, off 1 minute, on 3 seconds
    k. Turn on 1 second
15. Selectable daylight saving time bypass.
16. Selectable automatic channel scanning.
17. Computer programmable through transmitter, with automatic backup, and schedule changes which easy to make.
18. Switching information stored in non-volatile memory in the transmitter and broadcast at regular intervals. Each switch retains its instructions in non-volatile memory.
19. WT generator shall be factory preset as follows:
    a. Channel I.D. No.: 1
    b. Switch: 00
    c. Volume: 25 percent

K. Software

1. Provide Primex Wireless Scheduler Model 14003 software for installation and programming by Owner, compatible with the following PC operating systems:
   a. Windows XP with valid administrator rights.
2. Software shall be in form of a CD, suitable for operation in standard CD-ROM drives.

3. Provide one cable, RS232 (9 wires straight through DB9-F/DB9-M) with USB-to-serial adapter is required for use in downloading programmed software to the WT generator. A hard connection between a suitable computer and the system transmitter is required for schedule download.
4. Provide Primex Wireless Scheduler Transceiver Model 14270 to download schedule to system transmitter. (two transceivers included)
   a. Transmission.

      Frequency range: 902 Mhz – 923 Mhz.

      Peak power consumption: 200mA typical.

      Sensitivity: -113 dBm

      Range: 200ft.+ (indoor-environment dependent)

      Operating Temperature Range: -40º – 176ºF (-40o – 80oC)

      Humidity: 10% - 90%.

L. Attic Stock
   1. Electrical Contractor to turn over ten (10) additional 12-1/2" analog clocks to Owner for attic stock.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verify that construction is complete in spaces to receive equipment and that rooms are clean and dry.

B. Verify that 120-volt electrical outlet is located within 6 feet of location of transmitter and the outlet is operational and properly grounded.

C. Perform point-to-point check-out functional test with Owner/Engineer present. Submit report.

3.2 INSTALLATION

A. GPS Unit: Install on roof in location indicated, in clear view of the sky. Install unit in location free from standing water, and above accumulations of leaves or debris. Seal cable connection to GPS with cable connection sealant. Any added cable lengths must be protected from outside elements.

B. Transmitter:
   1. Locate transmitter where indicated, a minimum of 2 to 3 feet above the floor, away from large metal objects such as filing cabinets, lockers or metal framed walls. Transmitter(s) will be placed in 'MDF":
   2. Attach receiver to transmitter using cable.
   3. Connect antenna to transmitter, using care not to strip threads.
   4. Connect power supply to the transmitter.
   5. Set the channel number on the display to correspond to the FCC license.
   6. Plug power supply into electrical outlet.

C. Analog clocks: Perform the following operations with each clock:
   1. Install D-cell batteries.
   2. Set clock to correct time in accordance with manufacturer's instructions.
   3. Observe analog clock until valid signals are received and analog clock adjusts itself to correct time.

4. Install the analog clock on the wall in the indicated location, plumb, level and tight against the wall. Attach 12-1/2" clocks using clock-lock hanging method and suitable fasteners as approved by clock manufacturer.

D. Wire guards: Secure to wall, using approved theft-resistant fasteners.

E. Wireless Tone Generator:

1. Install the WT generator in location indicated, and secure to base using fasteners of type recommended by WT generator manufacturer, and suitable for the surface to which it is attached.
2. Align the antenna vertically.
3. Verify that the factory switch settings as specified above are correct. If changes are required due to field conditions, perform the following operations:
   a. Verify that the channel selector on the outside of the WT generator matches the selected channel on the transmitter.
   b. Verify the switch ID selector on the outside of the WT generator matches the selected switch ID number on the scheduling software.
   c. Remove the smaller cover, then the larger cover from the unit for access to the selector switches. Set the dip switches as required for daylight savings time adjustment (if applicable).
   d. Adjust WT generator volume as required.
4. Confirm proper installation of the WT generator and check volume by holding down the test function button.
5. Press the "reset" button to effect any changes in settings.
6. Relay output: If required, connect the relay output to the devices to be controlled. Confirm compatibility between relay output and devices.
7. Connect the WT generator to a standard 120-volt outlet.
8. Confirm that the green LED is flashing, to indicate that the WT generator is receiving a signal from the transmitter.

F. Primex Wireless Scheduler download sequence:

1. Plug female DB9 connector of serial cable to serial port connector of computer. Plug male DB9 connector to the "Computer Connection" port on back of transmitter.
   a. Plug female DB9 of serial cable into the serial port on the computer. Connect other end of cable to one transceiver module.
   b. Plug female DB9 of null modem cable too other transceiver module. Plug male DB9 to "Computer Connection" port on back of transmitter.
2. Download schedule per software instructions.

3.3 ADJUSTING

A. Prior to final acceptance, inspect each clock, adjust as required, and replace parts which are found defective.

3.4 CLEANING

A. Prior to final acceptance, clean exposed surfaces of clocks, using cleaning methods recommended by clock manufacturer. Remove temporary labels from clock faces. Do not remove labels from backs of clocks.

3.5 DEMONSTRATION

A. Provide training (4 hours minimum) to Owner's representative on setting and adjusting clocks, replacing batteries and routine maintenance.

3.6 PROTECTION

A. Protect finished installation until final acceptance of the project.

END OF SECTION

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SECTION 26 90 00
INTERCOM/TELEPHONE COMMUNICATIONS SYSTEM

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

A. The intent of this specification is to provide a complete and properly operating digital telephonic communications system with call processing, amplification, distribution and reproduction of voice and/or other audio program material and time keeping/Telemedia retrieval functions. The system shall be of modular design to facilitate both expansion and service and shall be completely solid state. All necessary hook-up and testing shall be by a factory approved representative.

B. The system shall be supplied by the manufacturer's authorized representative. Certification shall be submitted verifying that the contractor is the manufacturer's authorized representative. Included shall be certificates for attendance of manufacturer's installation/maintenance training by the contractor's directly employed personnel.

C. The system assemblies shall be completely factory built and tested by manufacturers of established reputation, who have and can refer to similar systems which are currently installed and functioning properly. The factory pre-assembled cabinets, consoles, and power supplies shall be approved and listed by a National Recognized Testing Laboratory (NRTL) such as ETL or UL.

D. The system shall be guaranteed for a period of one (1) -year from the date of acceptance or first beneficial use, whichever is first, against defects in materials, workmanship, design and improper adjustment. Any defects in the system shall be corrected at no expense to the Owner, provided the system does not show signs of abuse. During the guarantee period, any work found not to be in conformance with the plans, specifications and addenda, shall be brought into conformity with same at no additional cost to the Owner.

E. The equipment described herein, and furnished per these specifications, shall be supplied by one communications contractor. The contractor shall hold the necessary valid State of Delaware State Electrical Contractors License for this type of work. All reference to model numbers and other detailed descriptive data is intended to establish standards of design, performance, and quality as well as the requirements of the_____. The system shall be a Rauland-Borg Telecenter /Millennium, as furnished by:

Delmarva Systems Corporation

1100 First State Boulevard

Newport, Delaware 19804

<u>Acceptable Equivalent Manufacturers</u>

Subject to compliance with requirements, provide Intercom/Telephone Communications System of one of the following manufacturers:

Simplex/ADIX	Rauland Borg/Millenium
Bogen /Comdial	Dukane/Intercom

The specifications are designed and written around the characteristics of Rauland-Borg and represent the minimum requirements for all other listed manufacturers. Listed equivalent manufacturers must still meet all requirements of the base specifications in order to be approved.

F. Approval request for installation of equipment, not as specified herein, must be received by the Engineer not less than ten (10) days prior to bid opening. Proposals must be accompanied by complete technical data, as well as a list of at least 10 references for successful Digital Telephone, Intercom, Clock, Paging, Telemedia Retrieval system installations. All potential bidders submitting proposals for substitute system approval must provide a working demonstration

system upon request, for the Owner's inspection prior to final acceptance, to ensure that the submitted components are equal to the specified in all functional aspects. Demonstrations shall be provided at the Owner's chosen location at no cost or inconvenience to the Owner's personnel.

G. Alternative proposals, which are approved for bidding purposes only, will be published by addenda. Bidder shall provide all pertinent information, including: manufacturer specification sheets, working drawings, shop drawings, and a demonstration of the system.

H. Final approval of the alternate systems shall be determined at the time of job completion. Failure to provide a precise functional equivalent shall result in the removal of the alternate system at the installer's expense. Proposals not complying with the prior approval requirements and conditions set forth will be considered.

I. The communications contractor shall furnish all equipment, accessories, and material required for the installation of a comprehensive Intercom, Telephone, Call Processing, and Clock Communications system in strict compliance with these specifications and applicable contract drawings. Any material and/or equipment, not specified or described herein necessary for the proper operation of the system, shall be deemed part of this specification.

J. The contractor shall make available, and maintain a radio dispatched mobile service department capable of furnishing equipment inspection and timely service at the Owner's location. The contractor shall be prepared to offer a service contract for the maintenance of the system beyond the warranty period.

K. The contractor shall provide one-man day for training and instruction in the proper use, basic care, and maintenance of the equipment to personnel designated by the Owner. Such training shall be provided as an integral component of the system. These training sessions will be on both the general operation and basic programming of these systems. The contractor will also provide the Owner with limited programming access to the system. The main programming for the system shall be PC/Windows based for ease of operation. A videotape of the training session shall be provided to the Owner for future reference.

L. All systems herein specified shall be provided and installed by a factory authorized dealer for the equipment. All systems shall be supplied and installed by one systems contractor, who shall be the sole source, responsible party with complete authority over all aspects of the project. Certificates of authorization showing that the submitting contractor is qualified to install and maintain all the types of equipment shall be part of the submission process.

1.3 SUBMITTALS

A. Provide submittals as follows:

1. Shop drawings: Provide wiring diagrams for all field devices and riser diagram of system layout.
2. Provide complete catalog data sheets of all major components, including but not limited to:
   a. Integrated speaker control and digital telephone communication clock equipment racks and equipment.
   b. Administrative and staff telephone stations, station controls and displays.
   c. Classrooms and station equipment, jacks, and terminations.
   d. Classroom and hallway "amplified voice" speakers, outside paging speakers.
   e. Backboxes and specialty rough-ins.
   f. Wire, cable, jacks and termination fields.
3. Provide a floor plan diagram of the system installation details, indicating wiring lay out, proposed wire routing, rough-in and installation information.

1.4 OPERATIONS AND MAINTENANCE MANUALS

A. Provide three complete O&M manuals describing maintenance and operation of the system. Include descriptions and service data on all component parts. Manual shall also include the following:

1. Warranty statement indicating effective dates.
2. Complete engineering data on all systems furnished, including schematics of all equipment, shop drawings on all specially fabricated items, wiring diagrams of the system in its "as built" condition.
3. Instructions on operational procedures, including master and substation operation, standard and special codes and alarm maintenance indications and procedures.
4. A listing of all stations connected to the system, the power drawn by each speaker circuit, and the total load in watts connected to the amplifiers.
5. All system programming information and forms.

1.5 SCOPE

A. Provide a complete and comprehensive school Communications/Clock system. The system shall incorporate integrated Speaker Intercom and a fully non-blocking Digital Telecommunication system, capable of integrated LAN based call processing and connection to outside telephone lines as specified. All system functions shall be enabled by DTMF/microprocessor control. The communications system shall be provided by one supplier to assure smooth coordination of all communication needs. The system shall have the capabilities of processing voice/data transmission at the standard ISDN basic rate interface (BRI), to and from any administrative telephone station. The system shall accept direct DS-1 level interfaces. The system shall have a Computer Telephony Interface (CTI) conforming to Novell TSAPI standards for custom software applications.

1.6 SYSTEM CONTRACTOR QUALIFICATIONS

A. A "Systems Contractor" who has been regularly engaged in the furnishing and installation of commercial and industrial sound, communications and telephone systems and related visual communication systems and who can show evidence of successfully completing, with its present staff, products of similar size and scope. The systems contractor, not its employees, shall meet these qualifications.

B. The systems contractor shall demonstrate to the satisfaction of the Engineer it has:

1. Adequate plant and equipment to pursue the work properly and expeditiously.
2. Adequate staff and technical experience to implement the work.
3. Suitable financial status to meet the obligations of the work.
4. Technically capable and factory trained service personnel at a local service facility within a 40-mile radius of the project to provide routine and emergency service for all products used in the project.
5. Upon request, shall verify to the satisfaction of the Owner, that it has engineered, installed and maintained complete systems of comparable size and scope defined in the contract documents.

C. SYSTEM CONTRACTOR SHALL:

1. Be bondable
2. Provide written certification indicating said contractor to be Factory Authorized Distributor for the supplied system with full manufacturer's warranty privileges.

3. Supply Documents certifying successful completion by current employees of the manufacturer's technical training program(s).
4. Be established communications and electronics contractor for at least five (5) years.

D. Any contractor who intends to bid on this work and does not meet the requirements of the "Systems Contractor Qualifications", shall employ the services of a "Systems Contractor" who does meet the requirements and who will provide the specified equipment, shop fabricate the equipment racks and subassemblies, make all the connections to equipment and equipment racks, make all connections to remote controls and connection panels, and supervise the installation and connections of all system cabling and equipment.

E. A subcontractor so employed as the "Systems Contractor" shall be acceptable to the Architect/Engineer and shall be identified in the submittal.

1. General: All equipment and materials required for installation shall be new (less than 1 year from date of manufacture) without blemish or defect.
2. Specific: Each major component of equipment shall have the manufacturer's name, address and model number on a plate securely affixed in a conspicuous place. NEMA code ratings, NRTL label, or other data which is die-stamped into the surface of the equipment shall be easily visible.
3. Substitutions: It is not the intent of these specifications to limit or restrict submission of proposals for products by other manufacturers, but to set a baseline of operational performance and functionality which all bidding contractors must meet.
4. Where a specified piece of equipment has been discontinued and/or replaced by a new model, submission of the new model does not guarantee acceptance. Substitute items shall require evaluation by the Engineer prior to acceptance.
5. If substitute equipment is allowed prior to receipt of bids, and only by written addendum, the Systems Contractor shall be completely responsible for its use and for its ability to fulfill all intended functions in the completed system. The Systems Contractor shall replace all such equipment listed by type and model in the specifications if there is any evidence of equipment instability/or incompatibility.
6. Any use of substitute equipment shall be at no additional cost to the Owner.
7. If a bidder wishes to propose substitute equipment and/or a system to meet all of the functional requirements of this specification, but deviates from the equipment or system specified herein, by individual components or entire design philosophy, he is encouraged to do so. To be considered, the substitutes shall be accepted "as equal" in written addendum at least 10 days prior to the date bids are to be received. Submit the information required by this specification under "Submittals Prior to proceeding with the work" for review by the Architect.
8. Alternative proposals, which are approved for bidding purposes only, will be published by addenda. Systems which have been approved for bidding purposes only, that have been installed and do not comply with this specification, will be removed and replaced, by the installing systems contractor, with the specified system at no additional cost to the owner. Proposals not complying with the prior approval requirements and conditions set forth will not be considered.

1.7 MANUFACTURER

A. The manufacturer shall be a United States manufacturer, who has been regularly engaged in the manufacture of communication systems for at least thirty (30) years.

1. The equipment described herein, and furnished per these specifications, shall be provided by

one manufacturer. All reference to model numbers and other detailed descriptive data is intended to establish standards of design, performance and quality, as required. Equipment manufactured and supplied by Rauland-Borg Corporation or approved equal, shall be acceptable.

1.8 FUNCTION/OPERATIONS – INTERCOM/TELEPHONE

A. The communications system shall provide a comprehensive microprocessor controlled, multiple talkback network between telephone stations and intercom speakers.

B. The Central switching exchange shall be a microprocessor controlled unit and shall provide the memory, logic, sensing, and control circuitry for the system. The system shall lend itself to modular expansion to a total capacity of 250 stations.

C. The central switching exchange shall utilize standard dual-tone multi-frequency (DTMF) signaling for conformance with standard telephone practices.

D. The system shall provide direct dialing, full duplex private telephone communications between all locations equipped with administrative telephones, feature telephones, and staff telephones.

E. The central switching exchange shall provide a RS-232C serial data port for connection to a computer for on-site diagnostics or via a modem to a remote computer for off-site diagnostic functions by distributor or manufacturer personnel. It shall be possible to determine circuit and software faults via these diagnostics and to facilitate remote software changes. The system shall maintain statistics of operations of the main system functions for use by the individual administering the system.

Minimum diagnostic functions shall include:

A. Check active list of activity within system.

B. DTMF test, to check the DTMF registers.

C. I/O diagnostics shall enable the checking of each line, and each device connected in the circuit.

D. Capability of checking each link, and ability to remotely block a link from the system if found defective.

E. The system shall provide telephone service to administrators and to classroom.

F. The telecommunication system shall provide for direct connection to central office telephone lines (CO Trunks). Initially the system shall be equipped for (24) trunks and wired for (38) trunks.

G. The system shall offer routing of inbound trunks for:

- Attendant Answer Incoming (AAI)
- Direct Inward Dialing (DID)
- Direct Inward Line (DIL)
- Private Direct Inward Line (PDIL)
- Direct Inward System Access (DISA)

It shall also provide all standard Telco signaling to interface with other special services such as off-premise extensions (OPX), WATS, and CENTREX. Incoming Caller ID (ICLID) shall also be supported on all inbound trunks.

H. The system shall be capable of operating with either loop start or ground start trunks for compatibility with existing and future utility services. The system shall also be capable of operating with E&M Tie Trunks (2 / 4 wire audio, type I / II signaling.)

I. The system shall offer full flexibility of software restrictions to station lines for external calling capability. Each station may be programmed as:

1. Totally restricted
2. Restricted access
   a. Long distance access
   b. Area code access
   c. Local exchange access
3. No access to outside trunks

The installed system must maintain toll restriction at the station level, even when installed in CENTREX or other nested applications.

The system shall provide for Personal Identification Number (PIN) codes for selected administrators. By dialing their PIN code at any system telephone, the administrator shall have access to the same capabilities assigned to their office telephone, regardless of the restrictions on the phone on which they are dialing.

J. The system shall provide discriminating ringing to enable the party receiving a call to distinguish between an internal call (long ring) and an outside call (two short rings).

K. The system shall provide automatic hunting for the first available trunk for an outside line request. Both Rotary and Linear hunting shall be capable of partitioning to provide complete control over access to outside trunks.

The system shall provide a "re-order signal" to authorized telephones attempting to select an outside trunk.

The system shall provide trunk queuing to allow a station to queue on a group of lines. When a line becomes available, the system will automatically ring the queued phone, and then re-transmit the dialed number. It shall not be necessary for the user to re-dial the desired number.

The system shall provide a minimum of eight (8) trunk groups for the selection of outgoing lines.

The system shall support a minimum of 16 Least Cost Routing List Tables.

L. It shall prove possible to connect a CO trunk to the system which will directly ring a designated phone without the assistance of an operator, as for private line service. This call may be automatically routed to the attendant if it is not answered within a pre-determined time.

M. The system shall provide "Call Park" with remote pickup. This shall enable attendant to park call and permit paged party to remotely pickup outside call from any telephone.

N. Staff (classroom) telephones shall be standard utility grade digital telephones with built-in network and ringers. Systems which do not provide standard telephones shall not be considered acceptable. All classroom telephones shall be equipped with a standard DTMF touch-tone dial pad. A standard message waiting lamp shall also be provided at all stations.

Provide two-wire balanced audio transmission with dial tone, ringing and message waiting indication on all single line administrative and classroom telephones.

O. Provide conference calling and call transfer capability between all telephones.

Transferred calls to busy extensions shall automatically return to the party which originated the transfer. If the originating set is equipped with a display, a "Busy" message shall appear on the display.

P. Provide executive override permitting assigned telephones to break into ongoing conversations.

Q. The system shall allow any administrative telephone to remotely pick up a call from any other ringing telephone.

R. The system shall enable any administrative telephone to remotely answer any outside call on an AAI programmed trunk by dialing a pre-determined code.

S. The system shall be capable of providing "night answer." When placing the system in "night answer" mode, it shall be possible for an incoming call on any AAI trunk to be directed to a pre-determined extension. Night mode shall also provide a tone over system speaker signaling key personnel to answer the incoming call at any administrative telephone. This shall provide the ability to answer calls throughout the facility.

T. The system shall provide "Flexible Class of Service" to allow changes in system features and functions during selected hours. The following program changes in Class of Service shall be possible:

1. Trunk type assignments
2. Trunk routing assignments
3. Restrictions on individual telephones, including:
   - Outside line access
   - Toll restrictions
   - Paging access restrictions
   - Speaker first/phone first selection

It shall be possible to initiate Class of Service Changes either manually or automatically using the system's internal time base. Unless a request to the contrary is made by the Owner, the system shall automatically make the Class of Service change each day at 4:30 PM and 6:30 PM.

A minimum of four (4) independent program memory sets shall be provided. The choice of time of service change and active memory set selected shall be completely programmable.

U. The system shall provide Direct Inward System Access (DISA). It shall be possible to access central switch functions (i.e., all page, zone page, direct room dialing, monitoring, etc.,) from any off-site touch tone telephone via an incoming CO Trunk. Only authorized individual may use this feature by dialing the dedicated trunk number and then dialing the system function. It shall also be possible to restrict access to this function by means of a password.

The system shall provide Supervised Disconnect capability. When the central office sends a disconnect signal, the system shall automatically terminate the speaker connection.

V. Provide Electronic Multi-Line Telephone Instruments (MLTI) as indicated in contract documents. These instruments shall provide speakerphone operations, programmable function keys, and optional LCD readouts. These instruments shall each have a unique station number, plus additional station numbers common to more than one multi-line instrument.

Providing two (2) consoles or telephones at the attendant position shall be considered in direct conflict with the intent of this specification and, therefore, shall be deemed not acceptable.

In addition, provide the following features and functions:

- The ability to identify, answer, place on hold, park, and route inbound calls from CO Trunks.
- The ability to directly access any assigned outside trunk.
- Any transferred call shall "Recall" to the party who originated the transfer after a predetermined period of time if the call is unanswered. An indication shall be given to the Attendant that this is a "Recall."
- Transferred calls to busy extensions shall automatically return to the party which originated the transfer. A "Busy" message shall appear on the display.
- The attendant shall have the ability to pre-screen outside calls.
- A LCD display shall be capable of displaying call-in's originated by intercom call-in buttons.

- The MLTI shall provide the ability to direct calls to selected extensions using dedicated pre-programmed direct select keys. The status of that extension shall be displayed on an indicator adjacent to the Direct Select Station Key.
- The MLTI shall provide keys programmable as trunk lines, operator lines, direct select telephones, direct select speakers, or special function access keys (all page, zone page, tone activation, etc.) Each key shall provide a status indicator adjacent to each key to indicate ringing, busy, incoming call and answered call. The MLTI shall provide the ability to direct calls to selected extensions using dedicated pre-programmed direct select keys.

  It shall be possible to increase the number of Direct Select Keys on an individual MLTI by adding modular DSS/BLF modules. The addition of DSS/BLF modules shall not decrease the station or trunk capacity of the system.
- Call-in information shall be received on the MLTI factory installed LCD display. This feature shall be programmable for each MLTI. Systems that require a separate display will be deemed unacceptable.
- Power to the MLTI's shall be provided by the switching equipment so that it can be protected by the switching system's UPS power backup. Disruption of power to the building shall not disrupt MLTI operation.
- Other features to be included on the MLTI's shall include:
  - Last number re-dial
  - Do not disturb touch point
  - Adjustable ringer volume
  - Adjustable handset transmit and receive volume
  - Transfer key
  - Prime line
  - On-Hook dialing with adjustable loudness internal loudspeaker
  - 3-Position slide switches for hands-free/tone/ call announce control
- The MLTI's shall be fully digital instruments.

W. The system shall provide a "Student Phone" operation. A Student Phone shall be provided which shall allow students to make telephone calls home, to arrange for after school rides, etc. Complete control shall be maintained over that telephone including the following:

- The system shall be capable of enabling the telephones during specific, desired, time periods. It shall be possible to enable and disable the Student Phone(s) manually from authorized administrative telephones.
- The system shall exercise complete, programmable toll restriction over the Student Phone. The system shall be capable of restricting the student phone to using only specific trunks.
- The system shall restrict the length of a conversation to a specific, programmable time period. If the conversation exceeds the time limit, a warning tone shall be sounded, followed ten seconds later by automatic disconnection.
- The system shall prevent any student from re-dialing a number, after a valid connection, from being redialed for a programmable time period.
- The Student Phone shall automatically be connected to an outside line. It shall not be necessary for the student to dial an access code to access a trunk. It shall not be possible to dial internal extensions or functions from the Student Phone.

X. The system shall be capable of providing "Music on Hold" to parties awaiting transfer.

Y. Other features to be provided by the system shall include:

- Call forward (no answer, busy, follow me)
- Call back – busy station
- Station message detail recording (SMDR)
- System speed dial
- Senderized dialing
- System clock

Z. The system shall provide facilities for both on-premise computer linkage using standard modems.

AA. Provide a built-in, auto-answer modem allowing off-premise troubleshooting and off-premise programming. Provide necessary outside line port for off-premise troubleshooting.

INTERCOM AND PUBLIC-ADDRESS OPERATION

AB. Each classroom shall be equipped with a speaker and a digital DTMF dialing telephone.

AC. The central switching exchange shall be supplied with one (1) two-way amplified communication path(s) to locations equipped with staff speakers. The intercom amplifiers shall be capable of delivering at least twelve (12) watts RMS and shall contain an automatic level control. Systems which are restricted to a single two-way amplified voice intercom path shall not be deemed acceptable.

Automatic "Queuing" for the two-way amplified communication paths shall be provided with "call waiting" to be automatically connected when the channel becomes available.

AD. The system shall provide automatic switching of the talk path to a telephone mode, during the course of a call, should the telephone associated with the speaker be lifted from its cradle.

System which do not allow for the automatic switching of the conversation from the speaker to the telephone shall not be considered acceptable.

AE. The system shall provide facilities for calling a staff (classroom) station by dialing the station number. Predetermination as to whether to ring the telephone or to permit talking over the speaker shall be user-selectable when dialing. Systems which do not provide this selectable feature or which require that separate numbers be dialed for the speaker and telephone shall not be acceptable.

AF. The system shall provide the capability of assigning speaker locations to any one or more of the eight (8) software programmable zones for zone paging or time signal reception. Systems using switches to assign zones shall not be acceptable.

AG. Provide for the distribution of emergency announcements and for the distribution of manually activated tones to all locations with speakers from any authorized telephone.

Through programming, it shall be possible to exclude selected speakers from the reception of paging announcements.

AH. Provide capability of restricting the origination of emergency announcements, all page, zone page, and alarm signal origination to specific assigned telephones.

The system shall provide for Personal Identification Numbers (PIN) for selected administrators. By dialing their PIN at any system telephone, the administrator shall have access to the same capabilities assigned to their office telephone, regardless of the restrictions on the phone he is currently using.

If the telephone originating a paging announcement is associated with a loudspeaker, the system shall automatically mute the speaker to avoid feedback.

AI. Provide facilities for answering calls registered in the display by pressing a single "response" button. This capability shall not prevent other calls from being placed or answered by dialing their numbers.

PROGRAM DISTRIBUTION OPERATION

AJ. The system shall provide facilities to distribute program material (i.e., music, radio broadcasts) in the following manner:

- The staff member shall approach the central control rack and insert a tape or tune desired radio broadcast utilizing the rack mounted tape-tuner unit.
- The staff member shall then "direct select" room(s) or areas to send the program via an easy to use color guided room position switch bank panel.
- The staff member shall have full view and choice of all the rooms and locations available.
- Program distribution by any other method shall be considered in direct conflict with the intent of the specification and automatically rejected.
- Systems which require that the operator return to the office administrative console to "dial up" or individually enter via a keypad, the rooms where program is to be sent shall not be acceptable under this specification.

1.9 FEATURES – TELEPHONE/INTERCOM

A. A fully integrated Digital Communications and Call Processing System shall be provided. The system shall provide for non-blocking internal and external communications from any telephone in the system by simple familiar touch pad dialing or accessed from the LAN computer terminals. Types and quantities of station instruments shall be as specified and as shown on the plans.

B. The system shall be equipped with digital DSS/BLF modules as shown on the plans. The DSS/BLF stations shall be able to monitor the status of any telephone in the system, and be able to call any station by simply depressing the associated key button. The DSS/BLF stations shall be labeled with the classroom number, staff station location, administrative location or desired architectural coding as indicated by the Owner.

Incoming calls to the Central Answering Position (CAP) from any telephone, call switch and handset in the system shall light the appropriate indicator on the BLF/DSS module and sound a tone to alert the operator of an incoming intercom call. The intercom call tone shall be distinctly different from outside line ringing tones.

C. The system shall have, at a minimum, the following features:

1. The system shall be completely solid state utilizing time division technology with stored digital program control and digital transmission. The system shall contain main operators consol(s) with DSS/BLF locations, as shown on the plans (CAP). Digital type telephones shall be utilized in classroom and staff locations as indicated on the plans. Multi-line telephones shall be used at the administrative locations, as specified herein and shown on the plans. Systems that cannot utilize all different types of devices will not be considered. The system shall be of American manufacture and registered under Part 15 (Class A) of the FCC regulations for connection to outside telephone lines. The system shall be capable of either "squared" or "non-squared" operation as desired.
2. The telephone system shall have unrestricted speech paths, with a non-blocking digital architecture and shall be fully integrated.
3. The system shall have the following wired capacity. Wired capacity is defined as the maximum configuration allowable on the system. This capacity may be obtained through the use of manufacturers' standard hardware and software expansion, as allowed by system architecture. Wired capacity shall be a standard configuration of the manufacturer.

Wired capacity: 32 lines by 192 stations

The system shall contain: All cabinets, wired, circuitry, circuit cards, power supplies, and programming firmware for the below installed capacities. Systems which require expansion cards or add on modules to reach the specified capacities must include these items under this specification.

Installed capacity: 24 lines by 84 stations.

4. Provide direct dial private two-way telephone communications with other administrative stations and staff stations.
5. Provide two-way amplified-voice communications with any station loudspeaker.
6. Systems programming shall be from a standard MS-DOS Computer Terminal (local or remote), and allowed administrative telephones. Class of Service Programming (COS) for system shall be on a per line/per station basis, allowing for flexible assignment of functions. Further, toll restriction administration class of service for enable and deny tables shall be class of service programmable by time of day.

D. The system shall offer at least the following standard operations:

Alpha-numeric calling party and line display

Automatic number I.D. (Caller I.D.)

Automatic route selection

Access denied

Call forwarding

Call conferencing (5 way unsupervised)

Call parking

Call pickup

Class of service (each station and line)

Class of service program storage to disk

Computer telephony interface (CTI)

DID trunk support

DISA trunk support

Night transfer of ringing assignments (3 schedules)

ISDN BRI data transmission

Off premise extensions

Open applications interface (OAI)

Music on hold

Power failure transfer

Station message detail reporting (SMDR)

Toll restriction (allow and deny tables)

Do not disturb

Station locking button

Station speed dial

System speed dial

TAP – Hookswitch flash for PBX functions

TSAPI/TAPI compliance and compatibility

Intercom system (telephone)

Intercom speaker system/programmable access

Intercom line lock-out

Mute of handset and microphone transmitters

Multiple attendant positions

Message waiting lamps

T-1 direct interface

Voice mail interface

Toll restriction override with access code

Least cost routing

Digit translation

E. Provide a Station Message Detail Report (SMDR) System. Included shall be all terminal equipment, wire, installation and programming to allow for local traffic analysis of the telephone system from any RS-232 compatible serial device (e.g., data printer). This feature shall allow for a record of calls to be kept for each telephone station in the system. All incoming and outgoing calls greater than 20 seconds in length shall be recorded. The outside telephone line used and digits dialed (up to 32) shall be recorded. On incoming calls, the answer time (in tenths of a minute) shall be kept.

F. The system shall be connected to the public telephone network. The communications system contractor shall develop a comprehensive cutover plan with the Owner's representative to ensure an orderly transition of service to the new telephone system. Provide Owner with all pertinent FCC registration numbers and RE numbers to allow for the connection of the system to the public telephone network as customer premise equipment.

G. All classrooms will have a built in PA system. This shall be accomplished by picking up the classroom phone and dialing its related speaker. Systems that do not comply with this feature will not be considered.

H. The system will allow for certain speakers or horns to be excluded from all-call, but will allow them to be included in a zone or in an emergency call. A list of speakers and horns will be provided by the Owner during setup.

I. The system will have both day and night COS assignments. This will allow for the same phone to maintain two COS services.

J. The system will allow for group listening for programmed administrators. This is used for the additional monitoring of conversations without the third parties knowledge.

K. The system will have provisions for supporting computer terminals on the digital ports. These computers will have the same features as administrative phones. These stations will also follow the same COS as any other station.

L. Interactive LCD's will allow the user access to a level of programming. This feature will allow the end user to create a more flexible station which will meet their needs.

M. The LCD's will log all calls. This creates a printout that can be retrieved at a later date on the SMDR report. These calls can be answered in the order that they were placed or in any order that the user chooses.

N. The system shall have a call processing system that will be compatible with the system. This will also turn on and off message waiting lights. The call processing system will have 10,000

mailboxes with 18 hours of recording time. The voice processing system shall be a Cortelco VPS.

O. Subdued Off-hook Voice Announce: A subdued announcement can be made from one station to another station that is off-hook and busy on a call. With this feature, the announcement is delivered and responded to in a subdued manner that prevents the distant party from hearing either the announcement or the response. Users can respond to the announcement in a verbal or non-verbal manner. They effect a response by pressing a Mute button or soft key response and speaking into the handset. They effect non-verbal response by pressing a pre-programmed button to send a message to be shown on the display of the announcing station (if it is an LCD speakerphone).

1.10 FUNCTION – REMOTE MAINTENANCE

A. Remote maintenance shall be provided for the entire system. It shall be possible to perform all programming and software maintenance functions on the system from a remote computer located at the installing contractor's site and/or from a central Owner maintenance location to be determined by the Owner. Automatic line sharing devices shall be included at remote sites so that an existing outside line resource may be used for remote maintenance when not being used for its primary function.

B. Provide, install and configure a complete and functioning remote maintenance system. System shall include, but not be limited to, all on site hardware and software, modems, transfer devices, installation, programming, testing, etc., and off-site modems, software, installation, programming, testing, etc. (Owner will provide a MS-DOS based computer for Owner remote end location).

C. Connect and test the remote maintenance functions for all of the systems under remote control. Perform actual remote maintenance operations from the Owner's remote site and demonstrate proper system operation in front of Owner's designated maintenance personnel.

D. Provide four (4) hours minimum instruction time in the operations of the remote maintenance features.

PART 2 – PRODUCTS

2.1 EQUIPMENT

A. EQUIPMENT ENCLOSURES: The Program Source Equipment shall be mounted in an upright equipment rack having 21" panel space and measuring 25-3/8" H x 22-3/8" W x 18-1/2" D. Color shall be black. System equipment shall mount on the telephone backboard or be rack mounted as required. All communication system/program equipment shall be provided as required to fully implement a function system.

B. ADMINISTRATIVE TELEPHONES: Shall be for desktop or wall mounting as indicated in contract documents. All Administrative telephones shall be American made digital DTMF touch dial type speakerphones, with 30-button capacity, and monitor speaker. All administrative telephones shall have full programmable access to internal intercom system, speaker intercom system and PBX/CO telephone functions. Administrative telephones shall have built in Liquid Crystal Display to give elapsed time of calls and 10 programmable messages. Any of the 30 dynamic "soft key" buttons shall be programmable for line access, DSS/BLF or speed dial functions as required. System-wide DSS/BLF module shall be supplied for Administrative telephones in the Main Office Answering Positions and in Administrator's Office, as shown on the plans. (Quantity 7).

1. The MAIN ATTENDANT CONSOLE (Central Answering Position) shall be an American made digital 30 button electronic DTMF dialing LCD display speaker phones with access to outside lines and Intercom Control Console as enabled by programming. Telephone shall have built in Liquid Crystal Display to give elapsed time of calls and 10 programmable

messages. Any of the 30 dynamic "soft key" buttons shall be programmable for line access, DSS/BLF or speed dial functions as required. The console shall have dedicated DSS/BLF positions for each telephone in the system. A monitor button and speakerphone shall be standard. The Console shall be programmed to provide message-waiting indication at selected stations. (Quantity 2).

C. STAFF STATION TELEPHONES: Shall be desk mounted as indicated in contract documents. They shall be American manufactured digital DTMF touch dial 18 button telephones with message waiting/incoming call light, Timed Hook Flash Button (TAP), hold button and LCD display. Access to outside telephone lines and the Intercom Central Control Console shall be available by programming. (Quantity of 10)

D. CLASSROOM TELEPHONES: Shall be desk mounted as indicated in contract documents. They shall be American manufactured digital DTMF 6 button with message waiting/incoming call light, Timed Hook Flash Button (TAP) and hold button. Access to outside telephone lines and the Intercom Central Control Console shall be available by programming. Multiple lines sets for Classroom Stations shall not be acceptable. (Quantity 50).

E. TELEPHONE CONTROL CABINET: Shall be a standard American made solid state device designed to operate at 117 VAC (+/- 10%) single phase. Switching principle shall be solid state, time division digital switching with stored program control. The Telephone Control Cabinet shall meet the regulatory standards of FCC Part 15 (Class A), EIA RS478, Bell 48002 guidance and be UL Listed. Loop limits shall be 1000' max. RS-232 serial ports (2), data storage interface, and PC control support shall be standard. Memory shall be fully protected by internal battery like device and shall keep program resident in memory for a minimum of 30 hours if power fails. customer programming shall be downloaded onto floppy disk as a permanent record and delivered with Operations Manual to Owner. Connection and termination of lines and stations shall be via standard 50 pin female connectors. Capacity and features shall be as specified elsewhere herein.

Provide the system for 24 loop-start outgoing lines.

F. SPEAKERS, CEILING MOUNTED: Shall be 8" full range loudspeaker/baffle combination, 6 oz. nominal magnet weight, 7-watt continuous power, with matching dual 25/70 volt transformer. Transformer shall be capable of delivering at least six separate wattage taps from 1/8 watt to 4 watts. Flush mounted onto steel backbox. Quantity as shown on plans.

ACC1400 Speaker/Baffle Assembly

ACC1101 Enclosure

ACC1104 Tile Support

G. CLOCK/SPEAKER ASSEMBLIES: Shall consist of a flush clock speaker backbox, baffle, speaker transformer assembly and 12-inch analog clock. Provide the following:

Rauland USO-188

Rauland ACC1006

Rauland ACC1106

National 030-12EX-HH

H. OUTDOOR WEATHERPROOF PAGING/PROGRAM SPEAKERS: Shall be UL Listed, surface mounted moisture resistant type paging speakers for voice and tones with matching transformer. Quantity as shown on plans.

Rauland 3601

I. AM-FM ANTENNA: Provide a complete AM/FM antenna system, as required for proper radio reception. Provide a weather headed conduit run from roof to intercom junction box if required.

Provide all mounting and connection hardware to receive available off air channels. Feed from building cable system, provided under separate section, is an acceptable signal source. Installation shall be in accordance with latest safety standards. All masting and outdoor mountings shall be capable of withstanding winds of up to 100 MPH. Provide lightning protection and grounding as per National Electrical Codes.

J. SURGE PROTECTOR: Provide over voltage and transient spike surge protector to condition AC voltages into all microprocessor control systems.

K. Master clock shall be Rauland 2524 rack mounted master clock.

L. Classroom/Hallway clocks shall be National 030E-12EX series, 120 vac, 12" clocks. For hallway clocks provide 123-12EX-HH double-face assembly.

M. Cafeteria and Gym clocks shall be National 030-15EX, 120vac, 15" clocks w/shatterproof lens. Provide wireguards for clocks in the gym.

N. Provide one (1) TEAC PPDD-2400 5,-CD disc player in the main intercom rack.

O. Provide remote sound systems for the Gymnasium. Provide interface for All-Call override from the main intercom system. The remote sound systems shall include the following equipment:

1 Peavy IPA300T power amplifier

1 Peavy Automix mixer

2 Astatic CTM-88 microphone w/25 foot cable and mic stand

1 Lowell L50 series wall mounted equipment cabinet

2 Atlas/Soundolier S501 series wall mounted microphone jacks

1 Telex AAT-2N wireless transmitter (for the hearing impaired)

1 Telex HGA – 1- ½-wave antenna

2 Telex ARR-10N receivers w/HED – 1 headphone and 5 batteries

8 Musiccaster 100 speakers

P. Provide a remote sound system for the cafeteria. Provide interface for All-Call override from the main intercom system. Each system shall include the following equipment:

1 Biamp CMA120 mixer/amp

2 Astatic CTM-88 microphone w/25-foot cable and mic stand

1 Rauland 3601 15-watt horn speaker

1 Lowell L50 series wall mounted equipment cabinet

2 Atlas/Soundolier S501 series wall mounted microphone jacks

1 Telex AAT-2N wireless transmitter

1 Telex HGA – 1 – ½-wave antenna

2 Telex ARR-10N receivers w/HED – 1 headphone and 5 batteries

16 Rauland ACC1402 coaxial speaker assembly with backbox and tile support

PART 3 - EXECUTION

3.1 MATERIALS

A. Wiring:

1. Phones: 4-pair 24awg twisted pair solid copper under jacket CAT5E cable dedicated for each phone. See Section 16740.

2. Classroom speakers: 1 #22 twisted shielded pair stranded copper under jacket dedicated for

each speaker.

3. Hallway/outdoor speakers: #18 twisted pair stranded copper under jacket. Multiple speakers may be installed on a circuit as shown on plans.
4. Clocks: 12 gauge THHN.

B. JACKS: (Refer to Section 16740 for jack devices/terminations.) Communications system's contractor shall be responsible for all system wiring terminations.

3.2 EXECUTION

A. All work under this section shall be performed by persons having specific familiarity with telephone, data, and sound system installation. Upon request, the contractor shall submit resumes, references or other corroborating documentation, to the engineer to confirm the contractor's capabilities and experience.

B. GROUNDING: Except where specifically indicated otherwise, all exposed non-current carrying metallic parts of the communications system shall be grounded. This may be accomplished via a driven ground rod, cold water pipe or building power ground. If the building power ground is used, a separate ground conductor shall be used from the equipment to the grounding grid. All grounding shall be done with #6 solid copper wire or larger. The contractor shall use every effort to insure system stability and safety.

C. WIRING: A comprehensive, documented communications wiring system is to be installed. Wiring is to be identified by room number, segregated, neatly laced, and terminated on telephone type punch blocks. Backboards and cross connect fields shall be neatly organized as to function (i.e., intercom, telephone stations, data network, etc.). All termination points are to be labeled with function. Data cables shall be certified as usable and checked using the cable certification sheet. Data cables shall be labeled as per the date identification scheme.

3.3 TESTING AND TRAINING

A. Prior to connection of any terminal equipment, all cables shall be tested as per REA Spec. PC-4. Cables shall be tested for opens, splits, crossed pairs, shorts to ground and shield continuity. All defective cabling is to be replaced prior to device hook-up.

B. Upon completion of the installation, the contractor shall test each room station speaker and handset for proper operation. All telephones, programming and functions are to be tested for proper operation. All emergency and program functions are to be tested. Any malfunction shall be corrected prior to final acceptance.

C. Eight hours time shall be included in the bid for instruction of the Owner's personnel in proper operation and routine maintenance of the system. Instructions shall cover all materials indicated in the Owners and Operations Manual. The training shall be video-taped and the tape given to the Owner.

D. Three (3) copies of Operational Guidelines shall be given, in writing, so that key personnel have operation instructions for programming, station use and special features. Copies of these instructions shall be provided for permanent record in the Operations and Maintenance Manuals specified in Part 1.4 above.

END OF SECTION

SECTION 27 00 00
COMMUNICATIONS

PART 1 – GENERAL

1.1 GENERAL PROVISIONS

A. Refer to other sections for General Requirements, etc., which shall apply to the work specified in this section. The following specifications for network cabling are based on the Communications Cabling Construction Standards generated and implemented for all State of Delaware schools and was developed by the State of Delaware, Center for Educational Technology (DCET).

B. The following names shall be the only hardware and cable manufacturers considered for this project at this time:

1. Hardware
   a. Ortronics, Inc.
   b. Hubbell Premise Wiring Channel Solutions
   c. Systimax Solutions
   d. Siemon
   e. Leviton NextLAN
   f. Panduit
2. Wire and Cable

   <u>Indoor</u>

   a. Berk-Tek
   b. Mohawk/CDT

C. In general, the network sub-contractor will furnish, install and test all cabling and terminations herein specified for distribution of the station/field wiring.

D. It shall be the responsibility of this Contractor to obtain the 3/05 State Standards and Specifications. This document shall be a guideline for installation and basis for estimating.

E. The Electrical Contractor shall utilize one of the approved State of Delaware installing contractors as indicated on the State list. The contractors are approved for furnishing, installation and testing of the entire network. The contractor must be certified and authorized for the installation of premises cabling system and shall assume responsibility for certifying the installation and providing a warranty for a period of no less than 25 years.

1.2 SCOPE

A. Perform all work necessary and/or required and furnish all materials and equipment for a complete network cabling system as described herein.

B. The data communications system shall be installed, consisting of the following components:

1. Optical fiber network backbone
2. Twisted pair copper work station cabling
3. Work station outlets
4. Cable support system

The MDF shall be connected to each IDF via a single, twelve- strand, composite, optical fiber cable. Each classroom and office data outlet shall be connected to its respective IDF via a four twisted-pair, Cat 6 data cables.

C. The hardware shall include equipment racks, patch panels, station outlets, Cat 6 data cables, optical fiber cables, all required terminations and labeling to provide for a complete data distribution system.

D. In general, one or more data outlets shall be provided for each computer station in classrooms, library and in offices where indicated on floor plans. The teacher's station outlet located in each classroom shall have voice, data, and video cable connections.

1.3 SUBMITTALS

A. Furnish shop drawings and descriptive data, complete with project designations for the following:

1. Equipment Racks
2. Patch Panels
3. Station Outlets
4. Cat 6 Data/Volp Cables
5. Optical Fiber Cables – OS2 Single Mode
6. Cable Support System
7. Wire Management Materials
8. Video cables as indicated in schedule on drawing.

1.4 DOCUMENTATION

A. The contractor shall provide a complete system walk-through, by suitably qualified personnel, to personnel designated by the owner, to instruct them on the installed system's location, operation and maintenance.

B. Prior to assembly and installation, the contractor shall submit the following, on reproducible media, to the engineer for review

1. Final schematic drawings of all circuitry, including outlet conductor assignments and all component callouts.
2. Equipment modifications drawings.
3. Front mechanical drawings of each equipment rack.

C. At the completion of the installation, the contractor shall provide one (1) copy of each of the following:

1. Equipment manufacturer's operation and maintenance manuals for each piece of equipment.
2. "As-built" drawings for all equipment installed.
3. "As-built" drawings on contract blueprints of all wire, cable and conduit placement throughout the building.
4. "From-To" listing of in-building wiring and outlets, listing color coding scheme and conductor assignments.

PART 2 – PRODUCTS

2.1 DATA OUTLETS

A. The jacks used for the data outlets shall be of the modular snap-in type.. A modular 110 PCB RJ-45 telephone jack (45* angle) will be used for all CAT 6 data/volp grade cable terminations. All modular jacks will be mounted in a single or double gang faceplate based on the number of services required at that station. All RJ-45 jacks shall have dust covers installed.

The jack color code and lettering scheme is as follows:

1. Data/Voice Jack Cat 6 data grade cable blue tab – Data

2.2 MDF and IDF EQUIPMENT RACKS

A. The MDF and each IDF shall contain a minimum of one (1) 23.75” wide x 7’-0” high equipment rack to mount the data electronics and patch panels onto. The equipment racks shall have 77.75” of rack mounting space on 19” wide rails.

B. The free-standing equipment racks shall be steel, grounded and bolted to each other and to the slab. All racks shall include rack top cable tray, cable management equipment and a 120 volt power strip.

C. Provide one (1) server rack in MDF Room. Rack to be 4 post frame with steel rails, 44 rack units, 6” to 32” adjustable mounting rails. Black in color. Unit to be similar to Ortronics Mighty Mo 4-Mation Model No. OR-60400224 or approved equal.

2.3 HORIZONTAL DISTRIBUTION SYSTEM

A. Horizontal Cable Specifications:

Indoor:

1. Plenum, 4 pair, 24 awg, Category 6 data/voice cable (blue jacket).
2. Plenum, 12 strand, tight buffer, OS2 Single Mode fiber optic cable.
3. Plenum, 25 pair, 24 AWG, category 5E voice trunk lines.

B. Cable Support Systems:

1. Cable support system shall be a hanger and plastic mesh system designed to support Video cables, telephone cables and high performance data cables. Caddy Cat. No. CatTrax Series or approved equal.
2. Cable Tray shall be a 12” wide aluminum tray with a 4” load depth and 6” rung spacing. Tray shall be complete with all mounting hardware required. B-Line Systems, Inc. Cat. No. 25A06-12-144 or approved equal.

2.4 CABLE TERMINATIONS

A. All classroom data outlet jacks shall be wired with Cat 6 data cable using the TIA/EIA-568-B standards. In the IDF and MDF rooms the data contractor shall furnish and install rack mounted patch panels, the number of patch panels and number of required ports shall be based on the number of classroom data outlets being terminated. On the rear of these patch panels the data contractor shall terminate each Cat 6 cable from each classroom data outlet. Each port shall be labeled as to room and data outlet served.

B. All office, work and conference room data jacks shall be wired with Cat 6 data cable using the TIA/EIA-568-B standards. In the MDF/IDF room the data contractor shall furnish and install rack mounted patch panels, the number of patch panels and number of required ports shall be based on the number of data outlets being terminated. On the rear of these patch panels the data contractor shall terminate each Cat 6 data cable from the administration area. Each port shall be labeled as to room and data outlet served.

C. In the MDF/IDF room the data contractor shall furnish and install one (1) rack mount interconnect center, with required adapter plates on the MDF rack. The data contractor shall terminate each twelve (12) strand fiber optic cable from each classroom IDF rack and using duplex SC adapters.

D. In the MDF/IDF Rooms the data contractor shall furnish and install on the plywood backboards, the required number of 110 termination punch down blocks with block covers and wire manager to terminate all voice cable required. Each four (4) pair termination block shall be labeled as to room served.

E. In the MDF/IDF Rooms, the data contractor shall furnish and install on the plywood backboards, the required number of 110 termination punch down blocks with block covers and wire manager to terminate required 25 pair CAT 5E trunk cables required for each area voice lines.

PART 3 – EXECUTION

3.1 INSTALLATION PRACTICES

A. Installation shall include delivery, unloading, setting in place, fastening to walls, floors, ceilings, or other structures where required, interconnecting wiring of system components, equipment alignment and adjustment, and all other related work whether or not expressly defined herein. Installation shall be performed in accordance with applicable standards, codes, requirements and recommendations of National, State, and Local authorities having jurisdiction, and the N.E.C. (National Electrical Code).

B. All boxes, equipment, etc., shall be installed plumb and square, and firmly secured in place.

C. Conduit sleeves shall be installed from the station outlet to within 12” of the cable support system. These sleeves shall be the responsibility of the data contractor and are required to accommodate both the data and communication wiring. After completion of the data and communication wiring the data contractor shall fire seal all sleeves with a UL approved fire stop in accordance with the NFPA (National Fire Protection Agency).

D. All sleeves shall be EMT conduit installed with plastic conduit bushings to protect data and communication wiring from damage.

E. In all cases, the Fiber Optic, Cat 6 data, and all communication cables shall be installed above the ceiling structure in the cable support system. No cable shall be exposed on any ceiling or wall, nor shall any cable lay-on or be in contact with the ceiling structure or it’s support system. The data contractor shall furnish and install large conduit sleeves above non-accessible ceilings where the cable support system must pass through, these sleeves shall be sized to handle both data and communication cabling.

3.2 CABLE INSTALLATION

A. All data cables shall be installed in accordance with manufacturer’s recommended tension and bending specifications. Any lubricants used must be manufacturer guaranteed to be non-destructive to cable sheaths.

B. All data cables shall be permanently marked with a wrap-around vinyl self-laminating printable marker label (Thomas & Betts E-Z-CODE WSL or approved equivalent) at both ends. There shall be no unmarked cables within the system at any location. Labels shall contain the room number, and the location and drop number within the room. All labeling shall be typed onto the label, not handwritten. Label all cable ends and individual jacks. All jacks shall be labeled to provide visibility when viewed behind cabinets and desks. All cables shall be labeled with jack numbers to permit identification in the event of damage to jacks.

C. All data and communication cables shall not be run in close proximity to, in the same bundle, or parallel with power cables, in order to reduce signal contamination.

D. No cable shall be installed with a bend radius less than that recommended by the cable manufacturer.

3.3 FIBER OPTIC CABLE INSTALLATION

A. The fiber optic cable shall be installed in the cable support system and conduit sleeves from MDF to IDF and from IDF to classroom outlets in accordance with cable manufacturer’s recommended tension and bending specifications. It will be the responsibility of the data contractor to ensure the quality of the fiber optic cable when received and prior to installation.

B. All fiber optic cable terminations shall be furnished and installed in accordance with termination equipment manufacturer's recommended and required specifications. It will be the responsibility of the data contractor to ensure the quality of the terminations when installation is complete.

3.4 TESTING

A. General Test Procedures: Before an application for final acceptance of the work will be considered, all tests stated within this section shall be satisfactorily completed. The data work shall include miscellaneous tasks, (i.e.. removal of station faceplates) deemed necessary to demonstrate compliance with the requirements of the data specifications, and cable and equipment manufacturer's recommended installation procedures.

B. Upon completion of testing and problem resolution, all connections must be 100% error free: " Error Free" is defined to mean the item meets all the manufacturer's specifications and recommendations as published in their latest manufacturing manuals for proper installation and testing. In addition, the item must conform with all other related industrial practices and standards, Building Trades, and Electrical and Telecommunications Industry Standards and Practices.

C. Copper Cable Test Procedures: Contractor must complete cable system performance verifications on all copper and fiber cable as specified below and provide the test results. Category 6 and fiber optic cables must meet or exceed all manufacturer's and EIA/TIA standards for performance and installation.

1. All copper and fiber optic testing documentation is to be submitted.
2. After the installation is complete, in addition to any other required testing, the data contractor shall at a minimum, conduct and report on the following tests of copper cabling:
   a. MDF-to-IDF tests of all new pairs installed under this contract to determine continuity, shorts, crossed pairs, correct pinning and grounds.
   b. IDF to information outlet tests of all cable pairs installed under this contract to determine continuity, shorts, crossed pairs, correct pinning and grounds.
   c. The Category 6 cabling, serving jacks installed from the IDF closet to the data outlets at the workstations is to be manufacturer verified and warranted for Category 6 compliance. All manufacturer's performance certificates and extended warranties are to be provided upon completion of the testing and manufacturer certification.
   d. All Category 6 cabling is to be tested end to end and documented for Category 6 compliance at all frequencies up to and including 100 MHz. Such testing is to comply with procedures and standards outlined by the cable manufacturer and EIA/TIA TSB-67 concerning testing of Category 5e cable plant. A Microtest Pentascanner Level 11 tester with 2 Way Injector is the instrument to be used for such testing to insure that cable pairs are defect free. "Defect Free" for the copper cable is defined as a copper pair not having any pair reversals, split pairs, shorts or opens. Test results shall be provided to the Engineer within 2 days after testing or 5 days prior to the Owner connecting electronic equipment onto the cable network, whichever is sooner. The data contractor must also provide testing summary reports of all Category 5e cables including run numbers, and pass/fail results with respect to length, impedance, DC resistance, mutual capacitance, attenuation, NEXT loss and active ACR. The data contractor must also provide spread sheet analysis of the linearly dependent parameters of length DC resistance, mutual capacitance and attenuation the field measured values shall be compared to the specifications values on one spread sheet.

e. In the event that a Category 6 cable fails to perform to the manufacturer's specifications, the data contractor will remove the cable and replace it with a new cable. Replacing the defective cable at no additional expense to the contract.

f. End-to-end testing is required for every RJ-45 connection. "End-to-End" testing is defined here as testing all cable links to the very last termination point.

g. The data contractor shall provide copies of all copper cable test results.

D. Fiber Optic Cable Test Procedures: All fiber optic cables and associated equipment, must be thoroughly tested. The fiber optic cable will be accepted only after each strand is tested in accordance with the specifications defined herein. All strands are to be tested and found to be 100% acceptable.

1. The data contractor shall test all cables, connectors, associated equipment and hardware furnished and installed by the data contractor upon receipt of same as defined herein.

2. The following must be met for the testing of the fiber optic cable: As a minimum the data contractor shall test, as described below, all optical fiber cable strands installed within the scope of this project:

a. Fully test complete links only. Piecemeal testing is not acceptable.

b. Perform end-to-end, bi-directional attenuation (loss) test for each fiber strand at 850nm and 1300nm wavelengths. Conduct tests in accordance with E-526-14, method B and with test instrument manufacturer's published instructions.

1) Demonstrate that measured link loss does not exceed the value based on the number of noted connector pairs, the connector's published loss per mated pair and the cable's published loss based on distance.

2) Strands whose measured attenuation falls outside the acceptable range shall be subject to further inspection and testing to determine the nature of the fault.

3) Horizontal End-to-End testing of individual optical fibers is considered to be from each IDF closet to the data workstation outlet.

c. Faults related to connectorizations shall be corrected and the fiber re-tested as stated above until acceptable attenuation measurements are received.

d. Where defects are to be inherent in the fiber itself, notify the Engineer in writing. Upon obtaining approval by the Engineer, replace any cable having fewer than the manufacturer's guaranteed number of serviceable fibers.

e. Remove all newly installed defective cables from cable support system. Do not abandon cables in place.

f. All test results and corrective procedures are to be documented and submitted to the Engineer.

g. Recommended test equipment:

1) Optical fiber power meter and Light Source: Siecor CPM-950/1300 meter and OS-100D Light Source, or equivalent.

2) TDR-Tektrom TFP2 FiberMaster, Laser Precision TD-2000 or equivalent with 850nm and 1300nm emitter modules and bud copy printout, or equal.

3) Optical fiber inspection scope: Cambridge Instruments 10x fiber scope or equivalent.

h. All fiber optic cabling is to be installed in a manner to comply with and allows DCET to receive the manufacturer's extended warranty. The data contractor is to be certified and authorized to provide the extended warranty.

E. Replacement: Any fiber strand, connector, or module installed by the data contractor which fails to meet the loss budget or tests below the manufacturer's standards, shall be replaced at no additional cost to the project. The replacement cable, connector, or part shall be tested after repairs have been made to verify compliance. Only equipment that meets the installation requirements stated herein shall be accepted.

F. Documentation:

1. Proper labeling and documentation will allow a technician to quickly trace a particular cable link and will significantly reduce the time and cost of moves, adds, changes and troubleshooting. Both labeling and documentation depend on the use of a system-wide coding scheme that will identify and locate each component of the data system and allow all components to be linked in a logical fashion.
2. There are three components of wiring system documentation:
   a. Labeling data closet termination areas aids in identifying the source and function of a circuit.
   b. A labeling scheme simplifies the documentation process.
   c. "As-built" documents provide a permanent record of data infrastructure. These documents are a critical management resource. As a result, it is imperative that "as built" documentation be prepared as part of the data infrastructure project. In addition, these documents must be kept current throughout the system's life cycle.

G. Cable and Data Outlet Identification:

1. The data contractor shall furnish and install cable tags labeled with identifying cable numbers.
2. The data contractor shall clearly and consistently mark the appropriate designation strip labels on all hardware. Data contractor shall submit for approval a sample of all designation labels.
3. The data contractor shall affix outlet identification labels, machine printed or typed, with identifying cable numbers.
4. Subsequent to pulling and terminating cables, the data contractor shall place the appropriate cable tags within six (6) inches of each Category 5e cable and eighteen (18) inches of each optical fiber cable end.
5. If at any time during the project, the cable tape becomes illegible or removed, the data contractor shall immediately replace it with a duplicate preprinted cable tag.
6. The data contractor shall provide a listing keyed to cable types of all cable identification numbers.
7. Data contractor shall label each data outlet with the following label scheme:

   If the IDF closet "A" is the origination point of the cable feeding the data outlet "007"in classroom 129, the following is the configuration of the label to be installed;

   IDF Closet – Classroom-data outlet

   Example: A-129-007

   Data contractor will submit for approval sample of all data outlet designation labels.

H. As-Built Documentation:

1. Maintaining records and documents is the most important portion of the administration of a data infrastructure. Maintenance and moves, adds and changes can become very tedious if a current set of records and documents are not maintained. In fact, isolation and resolution of

problems are often delayed because configuration information is either unavailable or outdated.

2. Subsequent to the installation and prior to acceptance, the data contractor shall prepare and issue As-Built drawings, in an AutoCAD format latest version, that shall reflect the lengths of cables installed, the actual manner and conditions of installation, including all deletions from additions to or departures from the contract documents. The documents are to include the data outlet station numbers and cable routing where it varies from the original plan. A copy of these documents will be stored in the MDF, with a master copy located at the School District's office.

END OF SECTION

SECTION 28 31 11
DIGITAL, ADDRESSABLE FIRE ALARM SYSTEMS

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. It is the intent of these drawings, schedules and specifications to outline the scope of work required to furnish and install a complete and operating fire alarm and detection system for this project.

B. The following specifications and the associated drawings are for reference only and are to only indicate the intent for a required fire alarm system and the level of quality. These specifications and drawings shall not be used for the basis of providing a bid for the project. It will be the responsibility of the Electrical Contractor to obtain the services of a licensed fire alarm vendor in the State of Delaware to indicate the required items necessary for a complete and operational system as recognized by the NFPA, State Fire Marshal's Office and the ADA. This responsibility shall also include any coordination with fire protection interface, mechanical equipment shutdown, hood suppression interface, etc. During construction, the shop drawings shall be submitted and approved by the Authority Having Jurisdiction (AHJ). Any changes required by the AHJ during the shop drawing review or during the final walk-thru shall be the responsibility of the Electrical Contractor and shall not be passed on to the Owner, Architect or Engineer in the form of a change order.

C. Types of fire alarm and detection systems required in this section include the following:

Combination:	Manual and Automatic
Zoned:	Wing, Floor, Level, Area, Machine or Device
Non-Coded:	Continuous Signal

D. The system shall include all required hardware, raceways, interconnecting wiring and software to accomplish the intent of this specification and the contract drawings, whether or not specifically itemized herein.

E. All equipment furnished and installed shall be new and the latest state of the art products of a single manufacturer, engaged in the manufacturing and sale of the specified fire detection devices for over ten (10) years.

F. The system as specified shall be furnished, installed, tested and approved by the local Authority Having Jurisdiction, and shall be turned over to the owner in an operational condition. In the interest of job coordination and responsibility the installing contractor shall contract with a single supplier for fire alarm equipment, engineering, programming, inspection and tests, and shall be capable of providing a “UL Listing Certificate” for the complete system.

G. Demolition of existing fire alarm system, once the new system is installed, functioning and certified. Furnish temporary interface between the old existing system and the new fire alarm system, as both will exist side by side, during completion of the project. The Electrical Contractor shall not allow both the new and existing system manual pull stations to exist side by side and, therefore, confuse building personnel.

H. Coordinate with Mechanical Contractor to furnish operations for air handling unit shutdown.

1.2 QUALIFICATIONS OF INSTALLERS

A. Before commencing work, submit data showing that the manufacturer has successfully installed fire alarm systems of the size, scope, type and design in projects of this type.

B. The manufacturer's vendor and his fire protection engineer shall have a minimum of five (5) years experience in, and be licensed and certified in, the design and installation of the selected fire alarm system being furnished for this project.

C. The installing contractor shall submit copies of all required Licenses and Bonds for his selected equipment vender, his fire protection engineer and his own as may be required by the City, County and State of Delaware.

D. The selected vendor shall be qualified by "UL" for certifying fire alarm systems. Upon completion of the installation the vendor shall certify the final system meets "UL" ongoing maintenance.

1.3 MANUFACTURER'S REPRESENTATIVE

A. The electrical contractor shall furnish the services of a manufacturer factory trained and certified representative, experienced in the installation, operation, maintenance and service of the type of system being furnished. The representative shall be licensed in the State of Delaware. The representative shall supervise the installation, software documentation, adjustment, preliminary testing, final testing and certification of the system. The representative shall furnish the required instruction to the owner's personnel in the system's programming, operation and maintenance.

1.4 CODES, REGULATIONS AND STANDARDS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only. The latest version of each listed publication shall be used as a guide unless the authority having jurisdiction has adopted an earlier version.

B. Factory Mutual (FM)

1. FM AG Approval Guide

C. National Fire Protection Association (NFPA)

1. NFPA 70 National Electrical Code (NEC)
2. NFPA 72 National Fire Alarm Code
3. NFPA 90A Standard for the Installation of Air Conditioning and Ventilating Systems
4. NFPA 101 Life Safety Code
5. NFPA 170 Standard Fire Safety and Hazmat Symbols

D. Underwriters' Laboratories, Inc. (UL) Appropriate "UL" equipment standards

1. "UL" 864 Control Panels
2. "UL" 268 Smoke Detectors
3. "UL" 268A Smoke Detectors (HVAC)
4. "UL" 1076 Security
5. "UL" 1971 Standard for Visual Signaling Appliances

E. Building Codes

1. BOCA National Building Code and the BOCA Fire Code
2. Standard Building Code and the Standard Fire Code
3. Uniform Building Code and the Uniform Fire Code
4. International Building Code and the International Fire Code

F. State Codes and Regulations

1. Delaware State Fire Prevention Commission

2. State of Delaware
3. State Fire Prevention Regulations as amended through January 1995
4. Americans with Disabilities Act of 1990 and/or State and Local equivalency standards adopted by The Authority Having Jurisdiction.

1.5 COORDINATION

A. As a requirement of this project, the Electrical Contractor and/or his subcontractor or vendor shall furnish coordination for his equipment and layouts with other subcontractors or vendors furnishing equipment and services for Divisions 1 thru 23. Any and all contractors who install their equipment or furnish services prior to coordination, or any contractor who changes their equipment or services after coordination has occurred, without notifying associated subcontractors, shall be held responsible for making all required changes with no additional cost to the Owner, or delay in construction time.

B. The Mechanical, Plumbing, Fire Protection and Electrical Contractors are responsible to coordinate all manufacturer's recommended sizes for all circuit breakers, starters, disconnects, fuses, wire and conduit for all equipment. Submission of a shop drawing will certify that this has been completed.

C. The drawings and specifications reflect the type, number and size of services required for the equipment the design is based upon, should the supplying subcontractor elect to furnish an alternate piece of equipment requiring different services and/or space conditions, he shall inform the subcontractor furnishing those services and be held responsible to pay for all required changes as part of this contract.

1.6 SUBMITTALS

A. The installing contractor shall include the following information in his shop drawing equipment submittal:

1. Submit manufacturer's data on fire alarm and detection systems including, but not limited to, roughing-in diagrams and instructions for installation, operation and maintenance, suitable for inclusion in maintenance manuals. Also include a standard of a typical riser diagram and wiring diagram for equipment to be furnished and installed under this contract.
2. The fire alarm devices and equipment shown on the floor plans is indicated strictly to show intent and coordination with other trades, and shall not be taken to indicate a complete fire alarm and detection layout; meeting all NFPA, State and local codes for this project. It shall be the responsibility of the Electrical Contractor's sub-contractor/vendor and his fire protection engineer to produce a complete set of drawings indicating all required equipment, devices, wiring diagrams and components needed to meet and fulfill the requirements of the NFPA, State of Delaware's Office of the Fire Marshal and the Authority Having Jurisdiction.
3. One (1) complete set of the entire submittal shall be forwarded to the local Fire Marshal's Office for approval. The submission shall also include the following:
   a. Power calculations. Battery capacity calculations. Battery size shall be a minimum of 125 % of the calculated requirement.
   b. Supervisory power requirements for all equipment.
   c. Alarm power requirements for all equipment.
   d. Power supply justification showing power requirements for each of the system power supplies. Power supplies shall be sized to furnish the total connected load in a worst-case condition plus 25 % spare capacity.
   e. Voltage drop calculations for wiring runs demonstrating worst-case condition.

f. NAC circuit design shall incorporate a 15% spare capacity for future expansion.

The plan review by the Fire Marshal's Office shall be forwarded to the Project's Engineer, signed or under cover sheet, of approval from the Fire Marshal, as a shop drawing, once received in triplicate.

4. Complete manufacturer's catalog data including supervisory power usage, alarm power usage, physical dimensions, finish and mounting requirements.
5. Complete drawings covering the following shall be submitted by the Electrical Contractor for the proposed system:
   a. Floor plans in a CAD compatible format showing all equipment and raceways, marked for size, conductor count with type and size, showing the percentage of allowable National Electrical Code fill used.
   b. Furnish a fire alarm system matrix as referenced by NFPA 72 figure A-7.5.2.2 (1999). Matrix shall illustrate alarm input/output events in association with initiation devices. Matrix summary shall include system supervisory and trouble output functions.
   c. Include any and all departures, exceptions, variances or substitutions from these specifications and/or drawings at the time of bid.
6. Should the above-mentioned information not be included in the shop drawing submission, the submission shall be rejected without processing and returned to the contractor.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. The model numbers provided are for use with the Notifier NFS – 640 fire alarm system and outline the products to be furnished for this project.

B. Approved equipment manufacturers and installing vendors:
   1. Notifier
   2. Simplex.
   3. Edwards System Technology
   4. Gamewell
   5. Silent Knight
   6. Siemens
   7. Bosch-Radionics

C. Approved equipment manufacturers listed must be installed by an authorized distributor certified by the manufacturer for the sales, service, installation, and maintenance of the system.

D. These specifications are designed and written in such a manner as to represent the minimum Fire Alarm and Detection System requirements. Any other components not indicated in these specifications, but deemed necessary by the selected manufacturer, for a complete and operational system, shall be included at no additional cost to the owner.

E. Once the vendor's design has been through the Fire Marshal's Office, and received his approval and been submitted as shop drawings any additional devices required by the Fire Marshal shall be taken from the spare equipment list. Refer to paragraph 5.3 SPARE EQUIPMENT herein.

2.2 GENERAL SYSTEM OPERATION

A. When an alarm occurs on an initiating device, the control panel indicates the alarm condition until manually reset.

B. An alarm may be acknowledged by actuating the "ACKNOWLEDGE" switch. This shall silence the panel buzzer, and change the "SYSTEM ALARM" LED from flashing to steadily lit.

C. This project shall be provided with synchronized audible and visual signaling devices. Activation of the signal silence switch at the fire alarm panel shall cause the audible signal to stop. The visual signal shall continue. If a subsequent initiating device causes an alarm, the audible signal shall resound. The visual signals shall continue until the system is reset. Synchronization shall be provided so that horns and strobes on different circuits will operate in unison.

D. If the microprocessor fails, the system shall execute a default signaling program. This program will enable the panel to sound the audible signals and summon the Fire Department. Inability of the system to sound signals or summon the fire department during microprocessor failure shall not be acceptable.

E. A single ground or open on the system signaling line circuit shall not cause system malfunction, loss of operating power or the ability to report an alarm from all initiating devices. A wire to wire short on the signaling line circuit shall cause fault isolation modules on either side to open allowing operation of all analog/addressable devices not located between the activated fault isolation modules.

2.3 SPECIFIC OPERATIONS

A. Operation of a manual station or automatic activation of any smoke detector, heat detector, or kitchen hood suppression system, shall cause the following:

1. Indicate on the Fire Alarm Control Panel and Annunciator Panels the specific device in alarm via the English-language alphanumeric display. The "ALARM" LED shall also flash and the local audible device shall pulse.
2. All strobes to flash in unison. All horns to sound a synchronized “Code 3” output. All speakers within the gymnasium, cafeteria, and auditorium to broadcast a “Code 3” pre-alert tone followed by a prerecorded voice message of the owner’s choice.
3. Shutdown all air handling units in the vicinity of the alarm. Provide an addressable relay module at each air handling unit for connection to the low voltage shutdown control circuit. If a 120VAC control circuit is to be interrupted by the fire alarm system, provide an addressable control relay and isolation relay rated for the control circuit load.
4. Printing and history storage equipment shall log the information associated with each alarm condition, along with the time and date of each occurrence.
5. Release all electrically locked or held-open doors.
6. Transmit the fire alarm condition to a U.L. listed central monitoring station, to dispatch the local Fire Department.
7. Monitor the fire pump and generator per NFPA.

B. Supervisory/Trouble Operations

1. Alarm activation of a duct mounted smoke detector or sprinkler valve tamper switch, shall cause the exact device in alarm to be displayed on the fire alarm panel and remote annunciator alphanumeric display, and initiate a supervisory condition within the fire alarm panel.
2. Transmit a supervisory condition to the central monitoring facility.
3. Duct mounted smoke detectors, when in alarm, shall cause their associated air handling unit to shut down.
4. Activation of any trouble condition within the fire alarm system shall cause the trouble visual and audible indicators to operate within the fire alarm panel, the reason for the trouble

condition to be shown in plain English on the alphanumeric display, and a trouble condition to be transmitted to the central monitoring facility.

C. The fire alarm system is to be connected to a U.L. listed central monitoring station, with the following requirements:

1. The entire installation shall comply with the requirements of NFPA 72, 2002 Edition (Remote Station Protective Signaling System) utilizing a Digital Alarm Communicator Transmitter (DACT) and a Digital Alarm Communicator Receiver (DACR).
2. The fire alarm system shall transmit alarm, trouble, and supervisory conditions, a daily test signal and the other signals required by NFPA 72.
3. The contractor shall be responsible for the entire installation (wiring, mounting of system components, connections at panel and the Digital Alarm Communicator Transmitter, programming, and functional testing).
4. The contractor shall coordinate with the owner to provide off-site monitoring of the fire alarm system. Off-site monitoring shall be provided by the Owner's U.L. listed central station facility, and paid for by the Owner.
5. The owner shall be responsible for providing two (2) standard telephone lines at the rate demarcation point for connection to the fire alarm system dialer, and pay for all charges from the telephone company.
6. Digital alarm communicator transmitter shall be an integral component of the fire alarm control panel, and not a separate unit. Provide Notifier model UDACT Universal Digital Alarm Communicator Transmitter.

D. The fire alarm control panel shall be provided with a firefighter's one-way voice paging system.

1. The one-way voice paging system shall consist of a voice command center audio message generator with microphone and all-call pushbutton, pre-recorded voice message chip, speaker circuits with selector switches/status indicators, and audio amplifiers.

   Provide a minimum of (1) speaker circuit per area required to have voice evacuation signaling. Speaker circuits to be wired using a Style Y (Class B) circuit. Speaker circuits shall be provided with a maximum usage of 80% of it's rated maximum output, to allow for future additions. Provide calculations and supporting data in submittal booklet, for verification by review authorities. 25 watt audio amplifiers shall be provided so that no amplifier will exceed 80% of it's maximum capacity, to allow for future additions. Provide calculations and supporting data in submittal booklet, for verification by review authorities.

E. The fire alarm control panel shall be provided with strobe indicating circuits. Strobe circuits to be wired using a Style Y (Class B) circuit. Auxiliary power supplies and circuits shall be provided so that neither power supply or circuit will exceed 80% of its rated output, based on the strobe light intensities required by NFPA 72. Provide calculations and supporting data in submittal booklet, for verification by review authorities.

F. The fire alarm control panel shall be provided with a minimum of two (2) signaling line circuits, so that no one circuit exceeds 80% of its rated maximum. Provide calculations and supporting data in submittal booklet, for verification by review authorities.

   Signaling line circuits shall be wired using a Style 7 (Class A) circuit, incorporating fault isolation modules. Provide the required quantity of fault isolation modules so that no more than 20 analog/addressable devices are located between modules.

G. The fire alarm control panel components shall be housed in multiple cabinets of the same dimensions. All components shall be integrally compatible with the main central processor, to provide a neat, and professional appearance. The use of separate central processors, strobe power

supplies, or audio evacuation panels at the main fire alarm control panel location is forbidden. Remote audio/visual power supplies, as shown on the drawings, is acceptable. Care shall be taken during the system design phase so that both audible and visual signals located in the same viewing area will be synchronized.

H. The Fire Alarm Contractor shall provide required material and labor for the system to monitor the generator for generator running, generator fault and generator switch in non-automatic position.

2.4 SYSTEM COMPONENTS

A. The fire alarm control panel shall be Notifier model NFS-640 and shall contain a microprocessor based Central Processing Unit (CPU). The CPU shall communicate with and control the following types of equipment used to make up the system: intelligent detectors, addressable modules, printer, annunciators, and other system controlled devices.

1. The control panel shall provide for the connection of 396 intelligent/addressable devices, <u>without adding any additional components.</u> If more than 396 device count is required, provide additional CPU-640 central processor units as necessary to meet job requirements and spare capacities.
2. The central processor unit, in conjunction with the loop interface board, shall utilize the patented “Flash Scan” technology. This technology allows the fire alarm control panel to poll devices on the signaling line circuit in groups of 10, and “looks” for any state changes from each device. This provides faster response by the fire alarm panel to an “alarmed” device, instead of the traditional communications format where each device reports 100% of it’s characteristics to the fire alarm panel each time it is polled. Activation of system outputs shall be performed within 2 seconds of an initiating device being placed in an alarm condition, on a fully loaded system. SYSTEMS that utilize the traditional device polling and those that cannot provide the system output response, as stated, are not acceptable.
3. The central processor unit shall provide the following features:
   a. Individual microprocessor design with degrade mode operations
   b. Cooperating multi-detector sensing algorithms that allow the fire alarm panel to interpret signals from adjacent detectors to make an alarm decision.
   c. Fully field programmable
   d. RS-232 output, standard
   e. Alarm verification – provide 30 second verification of alarm condition for all analog sensors.
   f. Drift compensation
   g. Dirty detector and excessively dirty detector indications
   h. Analog sensor sensitivity testing from the fire alarm panel, meeting requirements of NFPA72.
   i. Dual walk test modes
   j. Individual point or zone read, and point or zone enable/disable
   k. Nine(9)sensitivity settings for analog smoke detectors
4. Provide integral audio message generator with microphone and all-call button, pre-recorded voice message chip, speaker circuits with selector switches/status indicators, and audio amplifiers.
5. Provide integral strobe circuits with selector switches/status indicators, auxiliary 24VDC power supplies, and signal synchronization modules.

6. Provide integral digital alarm communicator transmitter.
7. Provide battery backup.

B. Display Interface Assembly

1. The display interface assembly shall provide all the controls and indicators used by the system operator and may also be used to program all system operational parameters.
2. The display interface assembly shall include status information and custom alphanumeric labels for all intelligent detectors, addressable modules and software zones.
3. The display shall provide a 640 character back-lit alphanumeric liquid crystal display (LCD). It shall also provide 10 light emitting diodes (LEDs), that will indicate the status of the following system parameters: AC POWER, FIRE ALARM, PRE-ALARM, SYSTEM TROUBLE, SUPERVISORY, SIGNAL SILENCED, CPU FAILURE, POINT DISABLED, SECURITY ALERT, AND OTHER EVENT.
4. The display shall provide a QWERTY keyboard with control capability to command all system functions, entry of any alphabetic or numeric information, and field programming. Ten different password levels shall be available to allow customized levels of operator access to programming, point status and alter status menus. This shall be used by the owner to assign different levels of control and bypass capabilities to different employees based on their individual level of experience.
5. An intuitive user guidance program shall be standard, allowing personnel without any prior experience the ability to follow easy step-by-step instructions to access all information related to an alarm, supervisory, or trouble condition.
6. Five (5) dedicated pushbuttons shall be provided allowing simple “scroll by event” operations for particular active conditions in the system. One (1) button shall be provided to scroll only “Fire Alarm” conditions, one for “Security Alarms”, one for “Supervisory Alarms”, one for “Trouble Conditions”, and one for “Other Events”.
7. An interactive summary event counter shall be provided on the alphanumeric display to show the number of alarms, troubles, or supervisory conditions in the system.
8. The display shall include the following operator functions: SIGNAL SILENCE, RESET, DRILL AND ACKNOWLEDGE. In a network system, these commands shall be completed for the entire network.
9. Fire alarm systems that cannot provide the high level of display and control functions, as outlined, are not acceptable.
10. For fire alarm systems that cannot provide the annunciation and control, as outlined, they must install a “Network Reporting Terminal” (not a CRT and keyboard) at the fire alarm panel location.

C. Secondary Power Source

A secondary power source consisting of lead acid batteries shall be provided. Batteries shall be of sufficient capacity to provide power for the entire system upon loss of normal 120VAC power for a period of twenty-four (24) hours, with five (5) minutes of alarm signaling at the end of this twenty-four (24) hour period. However, the batteries provided shall be able to meet the high alarm current required. Remote audio/visual power supplies shall be provided with (24) hours of supervisory operation and (5) minutes of alarm operation.

2.5 REMOTE ALPHANUMERIC ANNUNCIATOR

A. The unit to be provided shall be manufactured by Notifier. It shall be housed in a recessed mount backbox with smoked lexan window and key lock.

B. The remote alphanumeric annunciator shall provide an 80-character alphanumeric display, along with system control buttons.

C. Provide a color, CAD-generated map of the building plan with suitable frame at the fire alarm control panel and remote annunciator panel(s) locations.

2.6 ADDRESSABLE MONITOR MODULE - STYLE B

A. The addressable monitor module shall be a normally open (N.O.) contact type detection device which communicates with the main panel through the signaling line circuit. The unit shall contain a sub-loop that is wired Style B (Class B) and supplies an address for UL listed normally open contact devices on the sub-loop that close on alarm. When any open contact closes, the unit module address is transmitted to the main panel system and indicates on the 80 character alphanumeric display.

B. The address of the module shall be set by (2) rotary switches on the base of the unit. These switches utilize numbers 0 to 9. The use of jumper pins or any other means, except as stated above, shall not be acceptable.

C. The unit shall be mounted in the same enclosure as any normally open device that it monitors - if space permits - or it can be mounted in a standard 4-inch square or octagonal electrical box.

D. Use for connection to manual pull stations, remote power supplies, etc.

2.7 ADDRESSABLE MONITOR MODULE - STYLE B/D

A. The addressable monitor module shall be a normally open (N.O.) contact type detection device which communicates with the main panel through the Addressable Monitor Module. The unit shall contain a sub-loop that is wired either Style B (Class B) or Style D (Class A) and supplies an address for UL listed normally open devices on the sub-loop that close on alarm. When any open contact closes, the module address is transmitted to the main panel and indicates on the 80-character alphanumeric display.

B. The address of the module shall be set by (2) rotary switches on the base of the unit. These switches utilize numbers 0 to 9. The use of the jumper pins or any other means, except as stated above, shall not be acceptable.

C. The unit shall be mounted in a standard 4-inch square X 2 1/8 inch deep square electrical box.

D. Use for connection to sprinkler waterflow/valve tamper switches, kitchen hood suppression panels, fire pumps, emergency generators, etc.

2.8 ADDRESSABLE OUTPUT MODULE

A. The Addressable Control Module shall energize upon alarm from any analog detector or monitor module or any combination of detectors and modules communicating with the NFS-640 control, or upon trouble from any analog detector or monitor module or any combination of detectors and modules communicating with the main panel control. A break in the wiring or removal of the module results in a fault message displaying on the panel, and the occurrence of a System Trouble. The module provides (2) sets of dry, form "C" relay contacts rated 2.0 Amp @ 30VDC (resistive). The module is used to supervise and control a Style Z or Style Y indicating appliance circuit when 24VDC is supplied to it from the Power Supply or Auxiliary Power Supply in the main panel.

B. The address of the modules shall be set by (2) rotary switches on the base of the unit. These switches utilize number 0 to 9. The use of jumper pins or any other means, except as stated above, shall not be acceptable.

C. The modules shall be mounted in a standard 4-inch square X 2 1/8 inch deep electrical box, with a 1 1/2 inch extension ring.

2.9 FAULT ISOLATOR MODULE

A. The module shall enable part of the signaling line circuit to continue operating when a short circuit occurs on it. A LED indicator shall blink in the normal condition and light during a short circuit condition. The module shall automatically restore the entire communications loop to the normal condition when the short circuit is removed.

2.10 MANUAL STATIONS

A. Manual stations shall be made of red phenolic resin plastic with "Fire" lettering, for semi-flush or surface mounting, and shall be of the double action design.

B. The station shall require two (2) distinct operations to actuate.

C. Once activated, stations shall not be resettable without the use of a key and physically opening the station to reset.

D. The key shall be the same as that used to open the control panel.

E. The station shall be a Notifier.

F. Provide monitor module for connection to the fire alarm system signaling line circuit.

G. Provide protective guard with 9VDC integral sounder, Safety Technology International model STI 1100 (flush) or STI 1200 (surface), for each manual pull station.

2.11 AUTOMATIC INITIATING DEVICES

A. Analog Photoelectric Sensor

1. These detectors shall be of the photoelectric type, using a light scattering diode and photo sensor, and of the low-profile design. Maximum height of detector shall be 2 inches.

2. Detectors shall be designed for two-wire non-polarized installation and multiple listed with control units having specific voltage current characteristics which are compatible with the detector circuitry.

3. The detector shall have 360° angle orientation (circumference) smoke entry characteristics, permitting maximum response to both visible and invisible products of combustion from any direction. The detector shall be capable of operation at altitudes up to 7,500 feet without adjustments.

4. The sensors shall continually monitor to measure any change in their sensitivity due to the environment (dirt, smoke, temperature, humidity, etc.). They shall give an advance indication to the main control panel of the need for maintenance and can be specific as to where the maintenance is needed. If local regulations permit, then selected maintenance may be performed as opposed to having to check the sensitivity of all sensors to assure overall performance when only a few may be dirty.

5. The sensor shall be of plug-in construction and is directly interchangeable in the same base with the analog heat sensor. A wide variety of bases, with built-in horn, etc. are available.

6. Remote LED annunciator capability shall be available as an optional accessory.

7. The sensor shall feature fully coated circuit boards, special insect and dirt protection and superior RF/transient protection.

8. The unit may be tested from the control panel or functional testing can be performed by applying a test magnet according to the test procedures.

9. The address of the detector shall be set by (2) rotary switches on the base of the detector. These switches utilize numbers 0 to 9. The use of jumper pins or any other means, except as stated above, shall not be acceptable.

10. The Analog Photoelectric Sensor shall be mounted to a standard 4-inch octagonal electrical box.

B. Duct Mounted Smoke Detector

1. The contractor shall furnish and install where shown on plans Notifier.
2. The duct housing contains an integral analog photoelectric type smoke detector. The exhaust sampling tube shall be molded into the base of the duct housing.
3. The address of the detector shall be set by (2) rotary switches on the base of the detector. These switches utilize numbers 0 to 9. The use of jumper pins or any other means, except as stated above, shall not be acceptable.
4. The detector shall be listed by Underwriters Laboratories, Inc. and approved by Factory Mutual under the current standards for photoelectric type duct smoke detectors - to allow remote functional testing without generating smoke.
5. Provide a remote test station for all duct mounted smoke detectors. Locate directly below unit in the suspended acoustic ceiling, or on wall at accessible location.

C. Analog Thermal Sensor

1. The series analog thermal sensors shall contain a state of the art electronic dual thermistor sensing circuit for fast response. These sensors provide open area protection with 50 foot spacing capability for rate of rise type and 25 feet spacing for fixed temperature type.
2. Two (2) LED's on each sensor light upon alarm and provide a local 360° visibility of alarm indication. The LEDS flash each time the unit is interrogated.
3. The sensor shall be of plug-in construction and is directly interchangeable in the same base with the intelligent photoelectric smoke sensor. The bases shall include a tamper-proof feature which, when activated, prevents removal of the sensor without the use of a tool.
4. The address of the detector shall be set by (2) rotary switches on the base of the detector. These switches utilize numbers 0 to 9. The use of jumper pins or any other means, except as stated above, shall not be acceptable.
5. The Analog Thermal Sensor shall be mounted to a standard 4-inch octagonal electrical box.

2.12 FIRE ALARM SIGNALING APPLIANCES

A. Audio Signaling Appliance (Speaker-2 watt maximum)

1. The unit to be provided shall be manufactured by Notifier.
2. Speaker shall be comprised of a 4” voice cone with magnet, 25 watt audio transformer with ¼ / ½ / 1 / 2 watt taps, and a flush mount grille. Provide U.L. listed backbox skirt for a finished and professional appearance, where surface mounted. Provide 4” speaker support bracket for drop ceiling installations.
3. Unit to be white in color.

B. High Output Audio Signaling Appliance (Speaker - 15 watt maximum)

1. The unit to be provided shall be manufactured by Atlas Soundolier.
2. Speaker shall be of the re-entrant compression driver type, 4” square voice cone with magnet, 25-watt audio transformer with multi-tap configuration up to 15 watts, and a semi-flush housing. Provide U.L. listed backbox skirt for a finished and professional appearance, where surface mounted.
3. Unit to be red in color.

C. Audio Signaling Appliance (Trumpet Speaker)

1. The unit to be provided shall be manufactured by Wheelock.
2. Speaker shall consist of a high compression driver mounted to a cone shaped projector. Unit provided with an integral 25-watt audio transformer with multi-tap configuration up to 15 watts. Provided with an adjustable mounting base for exact directional positioning.
3. Mounts to a Wheelock surface mount backbox with adaptor plate. Unit to be red in color.

D. Visual Signaling Appliance

1. The unit to be provided shall be Notifier with mounting as required, for ceiling mounting. Device color shall be red for wall mounted applications, and white for ceiling mounted applications.
2. Unit shall produce a 15, 30, 75, 95, or 110 candela light output according to the UL1971 Polar Light Distribution measurement. It shall also produce the same light output near center axis. Strobe intensity to be provided as required by NFPA 72. Light intensities shown on drawings shall be used only as a basis for design. Field survey and adjust, if necessary, at no additional costs.
3. The unit shall be semi-flush mounted, if possible.
4. If the unit is to be surface mounted, install the matching backbox provided by the equipment manufacturer. The surface backbox shall be a finished product. Painted 4" square electrical boxes shall not be permitted.
5. The strobe shall interface with the Notifier Dual Synchronization module to provide synchronized operation.

E. Audio/Visual Signaling Appliance (Speaker/Strobe)

1. The unit to be provided shall be manufactured by Notifier with mounting as required, for ceiling mounting. Device color shall be red for wall mounted applications, and white for ceiling mounted applications.
2. It shall consist of a 4” voice evacuation speaker with multi-tap transformer with a UL1971/ADA Compliant Strobe. Strobe intensity to be provided as required by NFPA 72. Light intensities shown on drawings shall be used only as a basis for design. Field survey and adjust, if necessary, at no additional costs.
3. The speaker/strobe shall interface with the Notifier Dual Synchronization Module to provide synchronized operation.
4. The unit shall be semi-flush mounted, if possible.
5. If the unit is to be surface mounted, install the matching backbox skirt provided by the equipment manufacturer. The surface backbox shall be a finished product. Painted 4” square electrical boxes shall not be permitted.
6. Provide 4” speaker support bracket for drop ceiling installations.

F. Remote Audio/Visual Signal Power Supply

1. The unit to be provided shall be Notifier, 6A/24VDC, Addressable Charger/Power Supply with built-in signal synchronization modules.
2. The ACPS shall provide (5) fully addressable control inputs, one for each output circuit that are activated through the signaling line circuit in the fire alarm panel, one for synchronized horn input, and one monitor point for power supply trouble.

3. The use of separate addressable control modules, monitor modules, and synchronization modules shall be forbidden. Any fire alarm system that must be configured this way for proper operation is not acceptable.
4. It shall be possible to interconnect ACPS power supplies so that signal synchronization between power supplies can be provided.
5. The ACPS shall mount in (1) Notifier cabinet with (2) 7AH to 25AH batteries. Secondary power supply shall provide for (24) hours of standby operation followed by (5) minutes of alarm operation.
6. All communications inputs to the ACPS from the fire alarm control panel, and all outputs from the ACPS to the fire alarm control panel, shall be accomplished over the fire alarm system signaling line circuit(s).

SECTION 3 – EXECUTION

3.1 INSTALLER'S RESPONSIBILITIES

A. The installer shall coordinate the installation of the fire alarm equipment with the manufacturer's authorized representative.

B. All conductors and wiring shall be installed according to the manufacturer's recommendations.

C. It shall be the Installer's responsibility to coordinate with the supplier, regarding the correct wiring procedures before installing any conduits or conductors.

3.2 INSTALLATION OF SYSTEM COMPONENTS

A. System components shall be installed in accordance with the latest revisions of the appropriate NFPA pamphlets, the requirements contained herein, National Electrical Code, local and state regulations, the requirements of the fire department, and other applicable authorities having jurisdiction (AHJ).

B. All wiring shall be type FPLP for plenum installations and red in color. All fire alarm cable shall be installed above the acoustic ceiling or contained in building walls. Where a device is mounted on a masonry wall, install conduit stub within wall from device backbox to top of wall. All wiring shall be concealed and all backboxes recessed, where possible. Where wiring cannot be concealed, install cables in Wiremold 500 (Public Areas) EMT (Mechanical spaces) conduit. Where device backbox cannot be recessed in walls, provide the manufacturer's matching surface backbox.

C. Where wiring is run above acoustic ceiling, crawl spaces and pipe tunnels install cables in bridle rings connected to building steel supports. Install bridle ring every 6 feet. Cables shall not be ty-rapped to any pipes.

D. For fire alarm use, wire and cable shall be U.L. listed and be plenum rated, type FPLP.

E. Raceway containing conductors identified as "Fire Protective Alarm System" conductors shall not contain any other conductors and no AC current carrying conductors shall be allowed in the same raceway with the DC fire alarm detection and signaling conductors.

F. It shall be the responsibility of the contractor to coordinate the exact location of all installed equipment with all applicable trades.

G. Smoke and/or heat detectors shall be located 3 or more feet from any supply or return air register. Coordinate with mechanical contractor prior to final installation.

3.3 SPARE EQUIPMENT

A. The Electrical Contractor shall furnish up to twenty (20) in any combination of fire alarm devices selected by Owner, including but not limited to, smoke, heat, duct, monitor module, control monitor module or audio/visual devices for Owner spare.

3.4 ADDITIONAL SERVICES, GUARANTEE AND FINAL TEST

A. The contractor shall guarantee all equipment and wiring to be free from inherent mechanical and electrical defects for one (1) year (365 days) from the date of final acceptance.

B. In addition to the equipment shown on the project drawings, include twenty (20) additional peripheral devices of any type (i.e.: smoke detector, duct smoke detector, heat detector, pull station, monitor module, relay module, control module, horn/strobe, speaker/strobe, strobe, etc.). These devices may be installed at the discretion of the local Fire Marshal, the project engineer, or the licensed fire alarm company, upon review and/or testing performed by all.

If necessary, these devices, along with the required panel additions, wiring, labor, etc., shall be furnished and installed at no additional cost to the owner. If, at the end of the project, they are not required to be installed, they shall be given to the owner for their use.

C. Concurrent with the warranty period, the licensed fire alarm contractor shall provide (2) semi-annual inspections of the completed fire alarm system in accordance with the State of Delaware Fire Prevention Regulations. All costs shall be included in the contract amount. No additional fees will be paid by the owner for this service.

3.5 FINAL TEST

Before the installation shall be considered complete and acceptable by the awarding authority, a test on the system shall be performed as follows:

A. The contractor's job foreman, in the presence of a representative of the owner, and the fire marshal's office shall operate every building fire alarm device to ensure proper operation and correct annunciation at each remote annunciator and control panel.

B. One half (1/2) of all tests shall be performed on battery standby power.

C. Where application of heat would destroy any detector, it may be manually activated.

D. When the testing has been completed to the satisfaction of both the contractor's job foremen and the representatives of the manufacturer and owner, a State of Delaware "Fire Alarm Signaling System Certificate of Installation" shall be completed and signed by the necessary personnel.

E. The contractor shall leave the fire alarm system in proper working order, and without additional expense to the owner, shall replace any defective materials or equipment provided by him under this contract within one (1) year (365 days) from the date of final acceptance by the awarding authority. Warranty work shall be completed during normal business hours, a maximum of 24 hours after notification of the service request.

F. Provide service response within (1) hour during a "false alarm" condition.

3.6 AS BUILT DRAWINGS, TESTING, and MAINTENANCE INSTRUCTIONS

A. <u>As Built Drawings</u>

A complete set of reproducible "as-built" drawings showing installed wiring, specific interconnections between all equipment, and internal wiring of the equipment shall be delivered to the owner upon completion of system.

B. <u>Operating and Instruction Manuals</u>

Three (3) complete sets of operating and instruction manuals, each placed in a 3-ring binder, shall be delivered to the owner upon completion. Each manual shall contain a copy of the as-built fire alarm system drawings. The instruction period for the owner or it's representatives shall be 4 hours, performed during normal business hours.

C. <u>Testing Frequency Instructions</u>

1. Complete, accurate, step-by-step testing instructions giving recommended and required testing frequency of all equipment, methods for testing each individual piece of equipment,

and a complete trouble-shooting manual explaining how to test the primary internal parts of each piece of equipment shall be delivered to the owner upon completion of the system.

2. Maintenance instructions shall be complete, easy to read, understandable, and shall provide the following information:
   - Instruction on replacing any components of the system, including internal parts.
   - Instructions on periodic cleaning and adjustment of equipment with a schedule of these functions.

   A complete list of all equipment and components with information as to the address and phone number of both the manufacturer and local supplier of each item.
3. User operating instructions shall be provided, and prominently displayed on the cabinet front or on a separate sheet located next to the fire alarm control unit, in accordance with UL Standard #864.

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SECTION 28 90 00
AREA RESCUE SYSTEM

PART 1 – GENERAL

1.1 GENERAL

A. The Contractor shall furnish and install all equipment including, but not limited to, outlet boxes, conduit (with pull strings), wiring, telephones, annunciators and speakers as shown on the plans, and all other equipment necessary to provide a complete and operating Area of Rescue system. All equipment shall comply with ADA Code 4.3.11.4.

B. Equipment supplied by Simplex Time Recorder Co. shall be considered as meeting these specifications and as the base bid. Any alternate system must be approved by the specifying authority. Bidders supplying an alternate system must make the authority aware of their intentions and provide adequate information, including catalog cuts, working and shop drawings, and a demonstration of the proposed system at least 10 days prior to bid date. Any prior approval of an alternate system does not exempt the supplier from meeting the intent of these specifications. If the alternate system fails to provide all the requirements specified in this document, the Contractor shall be responsible for all costs associated with the removal and replacement of said equipment.

1.2 ACCEPTABLE MANUFACTURERS

Simplex

Cornell

Housing Devices

1.3 SUBMITTALS

A. Data sheets shall be provided on all equipment being provided.

B. Internal control cabinet drawings showing internal block diagram connections shall be provided.

C. Wiring diagrams showing typical field wiring connections shall be provided.

D. FCC registration number and certificate shall be provided.

1.4 QUALIFICATIONS

A. The Contractor shall be from an established and locally run business which has been operating in the area for a minimum of five years.

B. The Contractor shall show evidence that he maintains a service organization and parts inventory to adequately support the supplied equipment.

1.5 MAINTENANCE SERVICE

A. The Contractor shall provide a one-year guarantee of the installed system against defects in material and workmanship. All labor and materials shall be provided at no expense to the Owner. Guarantee period shall begin on the date of acceptance by the Owner or engineer.

B. A maintenance contract offering continued factory authorized service of this system shall be made available if requested by the Owner.

1.6 QUALITY ASSURANCE

A. The Contractor shall currently maintain a locally run business for a minimum of five years and shall be an authorized distributor of the supplied equipment with full warranty privileges.

B. The Contractor shall maintain at his facility the necessary spare parts in the proper proportion as recommended by the equipment manufacturer to maintain and service the equipment being supplied. This facility shall be available for inspection by the engineer.

C. The supplying Contractor shall have attended the manufacturer's installation and service school.

D. The Contractor shall furnish manufacturer's manuals of the completed system including individual specification sheets, schematics, inter-panel and intra-panel wiring diagrams. In addition, all information necessary for the proper operation of the system must be included. Any bidder using other than the specified equipment must provide this information prior to bidding.

E. As built drawings that include any changes to wiring, wiring designations, junction box labeling and any other pertinent information shall be supplied upon completion of project.

1.7 IN SERVICE TRAINING

A. The Contractor shall furnish training with the system. These sessions shall be broken into segments that will facilitate the training of individuals in operating Master Telephone equipment as well as call station panels. Operating manuals and users guides shall be provided at the time of the training.

1.8 WIRING

A. System wiring shall be CAT III, 22 AWG, UL Listed Cable . Wiring shall meet all established state and local electrical codes. All wiring shall test free from opens, grounds and shorts.

1.9 BASIC SYSTEM OPERATION

A. When the system is in normal operating mode, the Master Telephone Display shall indicate time and date. When operated, the system shall provide two way visual and audible communication between a Master location and Area of Rescue stations.

B. When an Emergency call is placed by an Area of Rescue station the Master Telephone shall ring and the display shall indicate the number of the calling station, along with the priority of the call. All Area of Rescue stations shall be displayed at an Emergency level. Provide a wall display is provided it shall display the call in red lettering. Communications is established by simply answering the Master Telephone. When communications is completed and the Master Telephone has been hung up, the display will continue to show the station number until the station has been reset (See Paragraph 1.9.C)

C. When an Emergency call is placed by an Area of Rescue station several indications must be provided at the station to assure the caller that the call is being processed. After pressing the call button, the caller will be provided with both a visual and audible confirmation. A call placed LED shall begin to flash rapidly and a short tone shall be generated over the speaker. When the call has been answered by the Master Telephone the LED shall flash at a slower rate and a connection tone shall be heard through the speaker. To eliminate confusion this tone shall be different than the confirmation tone. Full two-way voice communication shall be provided without the need of any push to talk switches. The caller simply talks in the direction of the intercom speaker. Upon completion of the call, the LED shall remain on steady providing visual indication that help is coming. The LED will not be turned off until building personnel have reported to the Area of Rescue. A reset is necessary at the station to turn the LED off and remove the call from the Master Telephone’s display queue. This is accomplished by a momentary rocker type push button on the station.

PART 2 – PRODUCTS

2.1 The installation shall include a comprehensive programmable microprocessor-based Area of Rescue communications system consisting of a central switching exchange capable of handling up to 48 Area of Rescue stations. The system shall be equipped for 6 stations.

2.2 All programmable functions shall be located in battery backed ram to prevent loss in a power failure condition.

2.3 System shall have provisions for battery back-up and charger specifically designed for use with system power supplies. Systems that use a uninterruptable AC power supply (UPS) system shall not be accepted.

2.4 The central switch shall utilize standard dual tone multi-frequency type decoding (DTMF) for interconnection with standard telephone systems.

2.5 The central switch shall provide an RS-232 port for connection of a call logging printer.

2.6 Provide an individual one (1) watt amplifier circuit for each Area of Rescue station to allow absolute flexibility and redundancy for emergency paging. Equipment requiring a single power amp for these functions shall size such an amplifier as to deliver a minimum of 1.5 watts per station to compensate for inherent transformer losses.

2.7 The system shall be provided with four (4) multifunction ports for Master Telephones and or connection to a loop start trunk port of a KEY or PBX telephone system. All communication between Master Telephones shall be non-blocking.

2.8 Incoming calls from any Area of Rescue station location may be directed to any of four (4) multifunction ports. It may also be possible to redirect these calls to a secondary Master Telephone or KSU/PBX system if there is no answer at the primary station.

2.9 The system shall be provided with voice synthesized call-in, providing the four multifunction ports with audible annunciation of the calling stations number. This enables the buildings telephone system to receive station identification numbers directly through the handset.

2.10 Nine (9) built in software definable signaling tones.

2.11 Two (2), three (3) or four (4) digit programmable Area of Rescue station numbers for individual station identification.

2.12 Eight (8) internal relays which can be activated manually from any Master Telephone or automatically by the CPU when Emergency conditions occur.

2.13 Caller I.D. information shall be provided at each of the four (4) ports for interfacing with a building PBX.

2.14 A call confirmation tone to the Area of Rescue station will be generated from the CPU to the station when a call is placed. This tone verifies to the caller that the call has been received by the CPU.

2.15 Dual chime pre-announce tone shall be generated to the station when the Master Telephone has answered and communications has been established.

2.16 Unanswered calls from ADA stations shall, after a user determined time, have their station I.D. number automatically announced over any one or group of system speakers or through the buildings paging system. This automatic page notifies key building personnel of an unanswered emergency condition.

2.17 The Master Telephone Station shall include the following:

A. A standard DTMF dialing instrument for voice communications with Area of Rescue stations. The instrument shall have an adjustable ringer volume for use in different environments.

B. A backlit operators display shall be provided at each designated Master Telephone. This 4 x 20 LCD display shall continually show time, day and date. In addition, it shall show up to three (3) incoming calls (the fourth line indicates how many additional calls are in the queue).

C. The Master Telephone and display shall be housed in a #18-gauge surface mounted steel enclosure with a locking front door. The enclosure shall be 9” W x 14”H x 4”D.

2.18 The Area of Rescue station assembly shall be constructed of #22-gauge steel with tamper proof mounting hardware. The station faceplate shall be 7-3/4” W x 6-3/8”H and be flush mounted. The faceplate shall have the following features:

A. A large format momentary pushbutton for placing call for help shall be provided. Push-button shall be domed in shape and be bright red in color. It shall be a minimum of 1-1/2 inch in diameter and be activated with a minimum of effort for ease of use. No other hardware shall protrude from the station as high as the pushbutton.

B. A 3” speaker shall be provided with a minimum frequency response of 250Hz-8kHz. It shall have a minimum voice coil diameter of 3/4", a 2.5-ounce magnet and be capable of handling 12 watts of program power.

C. A high brightness LED shall be provided. It shall pulse at a fast flash rate when a call has been place, pulse at a slow rate when the station is connected to the Master Telephone and will stay on steady after the Master Telephone has hung up indicating “help is coming”.

D. A momentary rocker type pushbutton reset switch will also be provided. The reset switch will provide the means to reset the “help is coming” light at the station and also reset the display at the Master Telephone. Building personnel must respond to the area that placed the call to reset the station. A password protected command code shall be provided to enable a general reset from the Master Telephone.

2.19 CABLES

A. All cable shall be as recommended by the manufacturer or an approved exact equivalent. All station wiring must be home run with individually jacketed cable.

B. All Area of Rescue station wiring shall be in accordance with current new construction wiring guidelines published by the manufacturer, including speaker, call switch, and reset switch/LED.

C. All interior Master Telephones shall be wired in accordance with current new construction wiring guidelines published by the manufacturer.

D. All operator displays shall be connected to the system in accordance with current new construction wiring guidelines as published by the manufacturer.

E. Transient suppression is required on all wiring leaving the building

F. All cables run in underground conduits must be suited for wet locations.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Complete system shall be installed in strict accordance with manufacturer's recommendations.

B. All wiring shall be installed in raceways where routed through plenum ceiling areas.

C. Station wiring shall be Southwest Wire and Cable, Inc. #141298 or equivalent.

D. Master Telephone enclosure shall be mounted 48” AFF to bottom of enclosure.

E. Area of Rescue station shall be mounted so that the bottom of enclosure is 38” AFF.

3.2 INSPECTION AND TEST UPON COMPLETION

A. Check-out and final connections to the 5115 system shall be made by a factory trained technician in the employ of a manufacturer of the products installed. In addition, factory trained technicians shall demonstrate operation of the complete system and each major component to the Owner.

B. System field wiring diagrams shall be provided to this subcontractor by the system manufacturer prior to installation.

C. All materials and installation shall be guaranteed to be free of defects in material and workmanship for one year after final acceptance of installation and test.

D. Upon completion of the installation, four (4) copies of complete operational instructions shall be furnished, complete with record drawings. Instructions shall include part numbers and names, addresses, and telephone numbers of parts source. Final payment shall not be made until operational manuals have been received.

E. Upon completion of the installation of the equipment, the electrical contractor shall provide to the engineer a signed statement form the equipment supplier that the system has been wired, tested, and functions properly according to the specifications.

F. Nothing herein contained shall be construed to relieve the Contractor from furnishing a complete and acceptable electrical wiring system in all its categories. The engineer will condemn and reject any materials or labor which are or may become detrimental to the accomplishment of the intentions of these specifications.

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SECTION 31 10 00

SITE CLEARING

PART 1 GENERAL

1.01 DESCRIPTION

A. Site Clearing shall consist of clearing of the site within the limits of construction to include the following:
   1. Removal and disposal of trees and brush, weeds, roots, and similar materials.
   2. Removal and disposal of structures, paving, base course, utilities, concrete sidewalks and aprons, and all other obstructions which are designated on the Plans for removal during construction.
   3. Protection of existing utilities and adjacent property, structures, benchmarks, and monuments.

1.02 STANDARDS

A. The quality and performance of work specified in this section shall be in accordance with the Delaware Department of Transportation Standard Specifications for Road and Bridge Construction, dated August 2016, latest revision (hereinafter referred to as the "Standard Specifications").
   1. Section 201: Clearing and Grubbing
   2. Section 212: Removal of Structures and Obstructions and Existing Portland Cement Concrete Paving, Curb, and Sidewalk

1.03 PHASING

A. Clearing, grubbing, and removal shall be performed prior to the grading and stripping operations, within the limits of grading, as indicated on the drawings and as specified herein. Following clearing, topsoil shall be stripped and stored for later use on the site or disposition by the Owner.

1.04 PROTECTION

A. The Contractor shall protect all trees, shrubs, ground plants, roads, walks, pavements, structures, civil improvements, and appurtenances not indicated to be cleared from the site. Methods of protection shall be by use of substantial wood or chain link fences, barriers, or other methods, as approved by the Engineer. Any trees, shrubs, ground plants, roads, walks, pavements, structures, or appurtenances indicated to remain that become damaged during construction of the project shall be repaired or replaced by the Contractor, as directed by the Engineer, at no additional cost to the Owner.

B. The Contractor shall contact all utility companies to mark the location of their facilities. The contractor shall protect all existing utilities in place and maintain continuous service to the Owner. Any damage to the utilities shall be corrected by the Contractor at his expense. The Contractor shall also be responsible for coordinating and/or relocating any utilities which must be relocated to accommodate the proposed construction.

PART 2 PRODUCTS

2.01 MATERIALS

A. All materials shall be at the Contractor's option, subject to the approval of the Engineer.

PART 3 EXECUTION

3.01 CLEARING AND GRUBBING

A. Clearing shall consist of the removal of all trees and shrubs, brush, down timber, rotten wood, heavy growth of grass and weeds, vines, rubbish, walks, roads, curbs, walls and foundations, existing utilities already abandoned, and all objectionable debris. All walls, foundations, slabs, pavements, curbs, and footings shall be removed to their full depth.

B. Grubbing shall consist of the removal of stumps, roots, root mats, stubs, buried logs, and other debris within the project limits. The Contractor shall remove all stumps and root mats in their entirety and all buried logs and other debris from within building areas and from the limits of proposed drives and walks. Within proposed lawn areas, stumps, roots and debris shall be removed to a minimum depth of one foot below design rough grade.

C. Construction methods shall be in accordance with Section 201 of the Standard Specifications.

3.02 DISPOSAL OF REMOVED MATERIALS

A. All timber and cleared materials shall become the property of the Contractor, and shall be disposed of by the Contractor. Burning of materials on site is prohibited.

B. Pavement, base course, concrete, utilities, and other obstructions shall be removed from the site and shall be disposed lawfully. The Contractor shall provide evidence of the lawful disposal when requested by the Owner or the Owner’s Representative.

3.03 SALVAGED MATERIALS

A. Materials listed to be salvaged for reuse shall be stored by the Contractor in such a manner to prevent damage to the material. Salvaged materials which are not reused shall be disposed of lawfully by the Contractor unless the Owner specifically requests to take possession of the material.

3.04 SITE DEMOLITION

A. Remove walks, roads, curbs, walls and foundations, existing utilities already abandoned, and all objectionable debris. All walls, foundations, slabs, pavements, curbs, and footings shall be removed to their full depth.

B. Procure all permits required for demolition and disposal. Coordinate utility work with utility companies and subcontractors. All debris shall be removed and disposed lawfully.

C. Where applicable, brace and shore all portions of the existing structure for safety and to maintain the integrity of the existing building. Provide protection for the general public. Disconnect all utilities prior to demolition in areas where live utilities may be located.

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SECTION 31 20 00

EARTHMOVING

PART 1 GENERAL

1.01 DESCRIPTION

A. Provide labor, materials, and equipment necessary to complete the work of this Section, including but not limited to the following:
   1. Filling and backfilling to attain indicated grades.
   2. Excavation, rough and finish grading.
   3. Furnishing and installing graded aggregate base course material for pavements, hot-mix patches and other structures.
   4. Undercut excavation and furnishing graded aggregate base course for undercut excavation.
   5. Furnishing excavation support systems, as required, including shoring and bracing.
   6. Excavation for trenches.
   7. Preparing topsoil stripped from the site and placing topsoil in locations requiring seeding or sodding.

B. Allowances and Unit Prices
   1. The Base Bid shall include an allowance for supplying and installing 400 Tons of Borrow Type "C" for trench backfill when suitable on-site material is not available. Said price shall include removal and disposal of any unsuitable on-site material.
   2. Provide a unit price for supplying and installing Borrow Type "C". This unit price will be used to increase or decrease the allowance based on actual field conditions. Refer to Part 4 of this section for measurement and payment.
   3. The Base Bid shall include an allowance for supplying and installing 500 Tons of Graded Aggregate Type "B" for Undercut Excavation when suitable onsite material is, in the opinion of the Engineer, not available to support proposed pavement loads.
   4. Provide a unit price for supplying and installing Graded Aggregate Basin Course Type "B" for Undercut Excavation. This unit price will be used to increase or decrease the allowance based on actual field conditions. Refer to Part 4 of this section for measurement and payment.
   5. Provide a unit price per square foot for supplying and installing Geotextile Stabilization Fabric for undercut excavation as described in Sections 2.06 and 3.03.D of this section. Refer to Part 4 of this section for measurement and payment.

C. Definitions
   1. Excavation: removal and disposal of all material encountered when establishing required grade elevations, including pavements and other obstructions visible on the ground surface, and underground structures and utilities indicated to be demolished and removed, and unsuitable subgrade material.
   2. Unauthorized excavation: Removal of materials beyond specified subgrade elevations without approval of Engineer.

1.02 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies
   1. All excavations shall be in compliance with Federal Occupational Safety and Health Act.
   2. Excavation work shall be in compliance with application requirements of other governing authorities having jurisdiction.

B. Standards
   1. Refer to the following sections in the Delaware Department of Transportation Standard Specifications for Road and Bridge Construction, dated August 2016, latest revision. (Hereinafter referred to as the "Standard Specifications")

      Section 202: Excavation and Embankment
      Section 207: Structural Excavation and Backfill
      Section 209: Borrow
      Section 301: Graded Aggregate Base Course
      Section 302: Stone
      Section 908: Soil Stabilization Practices
      Section 1001: Borrow
      Section 1004: Coarse Aggregate
      Section 1005: Graded Aggregates

   2. American Society for Testing and Materials (ASTM);
      D-1556: Density of Soil in Place by the Sand-Cone Method.
      D-698: Moisture Density Relations of Soils and Soil Aggregate Mixtures
      D-2049: Relative Density of Cohesionless Soils.
      D-2166: Unconfined Compressive Strength of Cohesive Soil.
      D-2922: Density of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow Depth)

1.03 SUBMITTALS

A. Material Certification and delivery Slips for:
   1. Select Borrow
   2. Graded Aggregate Base Course
   3. Bioretention Soil and Stone

1.04 JOB CONDITIONS

A. Existing Utilities
   1. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult the Utility Owner immediately for directions. Cooperate with the Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility Owner.
   2. Do not interrupt existing utilities serving facilities occupied and used by the Owner.

3. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies for shut-off of services if lines are active.

B. Use of Explosives: The use of explosives is not permitted unless approved by the Engineer.

C. Protection of Persons and Property
   1. Barricade open excavations occurring as part of this work and post with warning signs as required to protect persons on the site.
   2. Protect trees, shrubs, lawns and other features remaining as part of final landscaping.
   3. Protect structures, utilities, sidewalks, pavements and other facilities from damage caused by settlement lateral movement undermining, washout and other hazards created by earthwork operations.
   4. In the event of damage, immediately make all repairs and replacements to the approval of the Engineer at no cost to the Owner.

D. Dust Control
   1. Use all means necessary to control dust on and near the work if such dust is caused by the Contractor's operations during performance of the work or if resulting from the conditions in which the Contractor leaves the site.
   2. Thoroughly moisten all surfaces as required to prevent dust being a nuisance to the public, neighbors and concurrent performance of other work on the site.

E. Weather Conditions: Do not place, spread, or roll fill material during freezing, raining, or otherwise unfavorable weather conditions.

PART 2 PRODUCTS

2.01 GENERAL

A. For approval of borrow materials, at least five (5) working days in advance of intention to import material, designate the proposed borrow area, and provide samples to prove the quality and suitability of the material.

2.02 ON-SITE FILL

A. All on-site materials used for fill shall be acceptable to the Engineer and shall be minimally subject to the following requirements:
   1. Free from deleterious substances, stumps, brush, weeds, roots, sod, rubbish, garbage and matter that may decay.
   2. Free of large rocks or lumps that may create voids or prevent proper compaction.

2.03 BORROW FILL MATERIAL

A. Free from deleterious substances, stumps, brush, weeds, roots, sod, rubbish, garbage and matter that may decay, and shall be Borrow Type "C" conforming to Section 1001 of the

Standard Specifications. All excavated material which meets the requirements of Section 1001 of the Standard Specifications shall be used for borrow fill material.

2.04 TRENCH AND CIVIL STRUCTURE BACKFILL MATERIAL

A. Backfill for civil structures shall conform to the requirements of Section 209 of the Standard Specifications.

B. Backfill for trenches shall conform to the requirements of Section 209 of the Standard Specifications.

C. All trench and civil structure backfill material shall meet the requirements of Section 1001 of the Standard Specifications for Borrow Type C backfill. All suitable excavated material, which meets the requirements of Section 1001 of the Standard Specifications shall be used for structure or trench backfill as far as practicable.

2.05 GRADED AGGREGATE BASE COURSE

A. Graded Aggregate base course for bituminous and concrete pavements and other structures shall be Type "B" conforming to the requirements for Graded Aggregate in Sections 301 and 1005 of the Standard Specifications.

2.06 GEOTEXTILE STABILIZATION FABRIC

A. Geotextile stabilization fabric for undercut excavation shall be a woven polypropylene geotextile designed for base course reinforcement and subgrade stabilization. Geotextile shall have a minimum tensile strength of 500 lbs, and shall be Mirafi HP565, or approved equal.

2.07 TOPSOIL

A. Topsoil furnished from within or outside the project limits shall conform to Section 908 of the Standard Specifications except as modified by the following requirements.
   1. Topsoil shall not contain stones, lumps, roots or other objects larger than one-half inch in any dimension.
   2. Acid-Alkaline Range: pH 5.8 to 6.5.
   3. Free of pests, pest larvae, and matter toxic to plants.
   4. Maximum soluble salts: 500 ppm
   5. Free of viable Bermudagrass, quackgrass, Johnsongrass, nutsedge, poison ivy, Canada thistle, and other objectionable grassy or broadleaf weeds.

B. Topsoil Furnished from Outside Project Limits
   1. Gradation range:
      Sand (2.00 mm to 0.05 mm) 40-80 percent
      Silt (0.050 mm to 0.005 mm) 10-30 percent
      Clay (0.005 mm and smaller) 10-30 percent

a. When one-half of the sand content is larger than 0.500 mm, the maximum sand content shall be seventy-five percent; and maximum clay content shall be fifteen percent.
b. Lower limits of silt and clay shall be flexible to extent that soils with minimum combined silt and clay content of twenty percent shall be satisfactory. However, if more than one-half of the sand is larger than 0.50 mm., then minimum clay content shall be fifteen percent, or the minimum combined silt and clay content shall be twenty-five percent.

2. Organic content:
   a. Minimum of 2.75 percent by weight.
   b. If necessary, add peat at the rate necessary to attain minimum organic content.

2.08 SOIL AND STONE FOR BIORETENTION FACILITIES

A. Soil and stone for bioretention facilities shall be as specified on the Plans.

PART 3 EXECUTION

3.01 INSPECTION BY CONTRACTOR

A. Examine the areas and conditions under which excavating, filling and grading are to be performed. No extra cost or time allowances will be granted for conditions existing and visible at the time of the bid opening.

3.02 PREPARATION

A. Prior to commencement of work, establish location and extent of all utilities in the work areas. Maintain and protect, as required, existing utilities which pass through the work area.

B. Prior to excavation in pavement areas, saw cut existing pavement in accordance with Section 762 of the Standard Specifications.

3.03 EXCAVATION

A. Unauthorized Excavation

Unauthorized excavation shall not be at the Owner's expense. Under roadways and pipes, fill unauthorized excavation by removing all loosened material and providing select material as required to attain a firm and unyielding subgrade and/or foundation and to attain required grade elevations.

B. Rock Excavation

Rock Excavation shall apply to the removal of bedrock and ledgerock which cannot be accomplished without blasting or the use of rippers, and the use or disposal of such material. Excavation of material classified as "rock" shall conform to the requirements of Section 202 of the Standard Specifications.

C. Rock Excavation for Structures and Trenches shall apply to the removal, use, or disposal of all boulders or other detached stones having a volume of 1/3 cubic yard or more. Excavation of such material shall conform Section 202 of the Standard Specifications.

D. Undercut Excavation
   1. If unsuitable bearing materials are encountered at the required subgrade elevations notify the Engineer immediately.
   2. Unstable bearing materials shall be removed to a depth of one foot below subgrade unless increased by the Engineer. Place geotextile stabilization fabric and one foot of graded aggregate base course, Type B.
   3. Base course shall be placed and compacted in six-inch lifts.

E. Stability of Excavations
   1. Slope sides of excavations to comply with local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space.
   2. Maintain sides and slopes of excavations in a safe condition until completion of backfilling.

F. Shoring and Bracing
   1. Provide materials for shoring and bracing, such as sheet piling, uprights, stringers and cross-braces, in good serviceable condition.
   2. Establish requirements for trench shoring and bracing to comply with local codes and authorities having jurisdiction
   3. Maintain shoring and bracing in excavations regardless of time period excavations will be open.
   4. Brace, sheet, and support trench walls in such a manner that they will be safe and that the ground alongside the excavation will not slide or settle, and that all existing improvements of every kind, whether on public or private property, will be fully protected from damage.
   5. In the event of damage to such improvements, immediately make all repairs and replacements necessary at no additional cost to the Owner.
   6. Arrange bracing, sheeting and shoring so as to not place stress on any portion of the completed work until the general construction thereof has proceeded far enough to provide sufficient strength.
   7. Exercise care in the drawing and removal of sheeting, shoring, bracing and timbering to prevent collapse and caving of excavation faces being supported.

G. Dewatering
   1. Prevent surface water and subsurface or groundwater from flowing into excavations and from flooding the project site and surrounding area.
   2. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to the stability of subgrades and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water from excavations.
   3. Convey water removed from excavations and rainwater to collecting or runoff areas, which are not subject to erosion. Establish and maintain temporary drainage ditches and other diversions outside excavation limits for each structure. Do not use trench excavations as temporary drainage ditches.

H. Material Storage
   1. Stockpile satisfactory excavated materials where directed until required for use as backfill or fill. Place, grade and shape stockpiles for proper drainage.
   2. Locate and retain soil materials away from edge of excavations.
   3. Dispose of excess soil material and waste materials as herein specified. Excavated material unsuitable for backfilling shall be kept separate from other materials excavated, and disposed of. Materials suitable for backfilling shall not be disposed of until completion of filling or backfilling operations.

I. Excavation for Pavements and Pavement Patches
   1. Cut surface under pavements to comply with cross- sections, elevations and grades as shown.

J. Excavation for Trenches
   1. Dig trenches to the uniform width required for the particular item to be installed sufficiently wide to provide ample working room. Trench width to a point no less than two feet (2') above the outside top of pipe shall be the pipe outer diameter plus twenty-four inches (24").
   2. Excavate trenches to the depth indicated or required. Carry the depth of trenches for piping to establish the indicated flow lines and invert elevations. Beyond the building perimeter, keep bottoms of trenches for which elevations are not given sufficiently below finish grade to avoid freeze-ups.
   3. Trenches for pipes shall not be opened more than the number of linear feet of pipe that can be placed and backfilled in one (1) day.
   4. Grub roots and stumps within six inches (6") of outside surface of pipe bottom and sides to minimum depth of six inches (6") below grade. Backfill trenches with concrete where trench excavations pass within eighteen inches (18") of column or wall footings and which are carried below the bottom of such footings, or which pass under wall footings. Place concrete to the level of the bottom of adjacent footing.
   5. Pipe bedding shall be as shown on the Plans.

K. Cold Weather Protection
   1. Protect excavation bottoms against freezing when atmospheric temperature is less than thirty-five degrees (35°).

3.04 BACKFILL FILL AND COMPACTION

A. General
   1. The project Inspector or Engineer shall be notified 24 hours in advance of any fill, backfill or compaction operations.
   2. Place acceptable material in 8" lifts to required subgrade elevations.
   3. Fills: Use suitable material (per Section 2.2 of this section) obtained from on-site excavation, except use borrow material when suitable on-site material is not available or when specified by the Engineer or shown on the Plans.
   4. Backfilling: Use suitable material (per Section 2.2 of this section) obtained from on-site excavation, except use select backfill where indicated on Plans. Backfill to a height of two feet (2') above the top of pipe with earth free from stones, rock

fragments, dirt clogs or frozen material greater than two inches (2") in largest dimension.

5. Do not provide additional off-site borrow material until all acceptable excavated materials on the site have been utilized in the work unless approved by the Engineer.
6. Place the various types of materials in the areas as designated on the Plans.

B. Backfill excavation as promptly as work permits, but not until completion of the following:
1. Inspection, testing, approval and recording locations of underground utilities.
2. Removal of concrete formwork.
3. Removal of shoring and bracing, and backfilling of voids satisfactory materials. Cut off temporary sheet piling driven below bottom of structures and remove in manner to prevent settlement of the structure or utilities, or leave in place if required.
4. Removal of trash and debris.
5. Permanent or temporary horizontal bracing is in place on horizontally supported walls.

C. Backfilling Prior to Approvals
1. Should any of the work be so enclosed or covered up before it has been approved, uncover all such work at no additional cost to the Owner.
2. After the work has been completely tested, inspected and approved, make all repairs and replacements necessary to restore the work to the condition in which it was found at the time of uncovering, all at no additional cost to the Owner.

D. Ground Surface Preparation Prior to Filling
1. Remove all vegetation, debris, topsoil, unsatisfactory soil materials, obstructions and deleterious materials from existing ground surface to a depth of not less than four inches (4") and not more than six inches (6") prior to placement of fills. Plow, strip or break-up sloped surfaces steeper than one (1) vertical to four (4) horizontal to a depth of not less than six inches (6") so that fill material will bond with existing surface.
2. When existing ground surface has a density less than that specified under "Compaction," for the particular area classification, break up the ground surface, pulverize, moisture condition to the optimum moisture content, and compact to required depth and percentage of maximum density.

E. Placement and Compaction
1. Place backfill materials in layers not more than eight inches (8") in loose depth.
2. Control soil compaction during construction providing minimum percentage of density specified for each area classification listed below.
3. Pavement areas are defined, for the purpose of this Section, as extending a minimum of five feet (5') beyond the building and/or pavement.
4. Compact soil to not less than the following percentages of maximum dry density for soils which exhibit a well-defined moisture density relationship determined in accordance with ASTM D-1557; and not less than the following percentages of relative density determined in accordance with ASTM D-2049, for soils which will not exhibit a well-defined moisture-density relationship.
   a. Lawn or Unpaved Areas: Compact top six inches (6") of subgrade and each layer of backfill or fill material at 90 percent (90%) maximum dry density.

b. Walkways: Compact top six inches (6") of subgrade and each layer of backfill or full material at 95 percent (95%) maximum dry density.
c. Pavement Areas: Compact top twelve inches (12") of subgrade and each layer of backfill or fill material at 95 percent (95%) maximum dry density.
d. Base Course Materials: Compact each layer of base course material to 95% percent (95%) of maximum dry density.
e. Trench Stabilization Materials: Compact each layer of material to 95 percent (95%) of maximum dry density.

5. Moisture control:
   a. Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade, or layer of soil material, to prevent free water appearing on surface during or subsequent to compaction operations.
   b. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.
   c. Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by discing, harrowing or pulverizing until moisture content is reduced to a satisfactory value.
   d. Moisture condition fills materials to within 3 percent (3%) of the optimum moisture. Fill that is so wet that it is unstable under compaction equipment shall be dried and re-compacted to achieve a stable fill.
6. Puddling or jetting will not be permitted.
7. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice, or other unsuitable materials.
8. Place backfill and fill material evenly adjacent to structures, to be required elevations. Take care to prevent wedging action of backfill against structures by carrying the material uniformly around structure to approximately same elevation in each lift.
9. Compact backfill to height of two feet (2') above top of pipe using approved flat-faced mechanical tampers.

3.05 GRADING

A. General

Uniformly grade areas within limits of grading under this section, including adjacent transition areas. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades.

B. Grading Outside Building Lines

Grade areas adjacent to building lines to drain away from structures and to prevent ponding. Finish surfaces free from irregular surface changes, and as follows:

1. Lawn or unpaved areas: Finish area to receive topsoil to within not more than 0.10 feet above or below the required subgrade elevations.
2. Walks: Shape surface of areas under walks to line, grade and cross-section with finish surface not more than 0.10 feet above or below the required subgrade elevation

3. Pavement: Shape surface of areas under pavement line, grade and cross-section, with finish surface not more than 1/2 inch above or below the required subgrade elevation. All topsoil and other unsuitable material shall be removed and replaced with suitable backfill.

C. Compaction
1. After grading, compact subgrade surfaces to the depth and percentage of maximum density for each area classification.

D. Treating after Grading
1. After grading is completed, permit no further excavating, filling or grading.
2. Use all means necessary to prevent erosion of freshly graded areas during construction and until such time as permanent drainage and erosion control measures have been installed.

E. Subgrade Preparation
1. All subgrade preparation shall be performed in accordance with the applicable Sections of the Delaware Department of Transportation Standard Specifications except as may be modified by this Specification Section.
2. Subgrades for paving shall be firm and unyielding when proof-rolled in accordance with Section 202 of the Standard Specifications.

3.06 GRADED AGGREGATE BASE COURSE

A. General
1. Base Course consists of placing graded aggregate base course material in layers of specified thickness over subgrade surface to support pavements, pavement patches and structures, as shown on Plans.
2. Provide Base Course in accordance with Section 301 of the Standard Specifications, except as otherwise modified by this Specification Section.

B. Grade Control
1. During construction, maintain lines and grades including crown and cross-slope of base course.

C. Placing
1. Place base course material on prepared subgrade in layers of uniform thickness, conforming to indicated cross-section and thickness. Maintain optimum moisture content for compacting base course material during placement operations.
2. When a compacted base course is shown to be eight inches (8") or less, place material in a single layer. When shown to be more than eight inches (8") thick, place material in equal layers, except no single layer shall be more than eight inches (8") in thickness when compacted.
3. Spread, shape and compact all base course material deposited on the subgrade during the same day.

3.07 FIELD QUALITY CONTROL

A. Quality control testing during construction. Allow testing service to inspect and approve subgrades and fill layers before further construction work is performed.

B. If subgrade or fills which have been placed are below specified density, provide additional compaction and testing at no expense to the Owner. This shall include compaction and testing at areas initially tested and at other locations as directed.

3.08 MAINTENANCE

A. Protection of Graded Areas
   1. Protect newly graded areas from traffic and erosion. Keep free of trash and debris.
   2. Repair and establish grades in settled, eroded and rutted areas to specified tolerances.

B. Reconditioning Compacted Areas
   1. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape and compact to required density prior to further construction.

3.09 DISPOSAL OF EXCESS AND WASTE MATERIALS

A. Remove waste materials, including excess and unacceptable excavated material, trash and debris, and dispose of it off the Owner's property.

3.10 TOPSOILING

A. Preparation
   1. Verify that clearing, earthwork, grading and other preceding work affecting ground surface have been completed and that the area to be topsoiled is cleared, shaped, and dressed.
   2. Preparation of Topsoil Subsoil
      a. Shape and dress area to be topsoiled. This work includes grading to required lines and elevations; removal of all stones, clods, lumps two inches or larger in any dimension; removal of all wires, cables, pieces of concrete, tree roots, and debris or other unsuitable material.
      b. Do not proceed with installation of topsoil until this work has been approved.

B. Installation
   1. Place in even layers that will produce the minimum compacted thickness as indicated on the Plans.
   2. If quantity of topsoil obtained from stripping is insufficient for the project requirements, provide required topsoil from approved sources located outside project limits.
   3. Remove stones, lumps, roots and other objects larger than one inch in any dimension from graded topsoil surface.

C. Maintenance
   1. Immediately before establishment of ground cover, re-topsoil and regrade areas, which become eroded or otherwise disturbed.
   2. Perform all maintenance work in accordance with the Specifications without additional compensation.
   3. Maintenance period to extend until installation of ground cover.

D. Cleaning
   1. Immediately clean spills, soil, and conditioners on paved and finished areas.
   2. Haul and dispose of topsoil in excess of the quantity required for the project off site.
   3. Dispose of protective barricades and warning signs at termination of maintenance period.

PART 4 MEASUREMENT AND PAYMENT

4.1 METHOD OF MEASUREMENT

A. No separate measurement or payment will be made for any earthwork needed to complete the work shown on the Plans or described herein except as noted in this Section.

B. Borrow Type "C" for utility trenches will be measured by the actual number of tons of Borrow Type "C" delivered, in place, and accepted. Certified weight slips signifying the weight of each load of materials delivered and placed shall be submitted to the Owner's Representative.

C. Graded Aggregate Type "B" for Undercut Excavation will be measured by the actual number of tons of Graded Aggregate Type "B" delivered, in place, and accepted for undercut excavation. Certified weight slips signifying the weight of each load of materials delivered and placed shall be submitted to the Owner's Representative. No separate measurement or payment will be made for graded aggregate supplied for pavement, sidewalk, or construction other than for undercut excavation, nor will measurement or payment be made for the volume of unsuitable material excavated and disposed.

D. Geotextile Stabilization Fabric will be measured by the square footage of geotextile stabilization fabric installed for undercut excavation, in place and accepted.

4.2 BASIS OF PAYMENT

A. Borrow Type "C", measured as provided above, shall be paid for at the contract unit price per ton bid for this item, which price and payment shall constitute full compensation for supplying, installing, and compacting said materials, including all equipment, tools, labor, and incidentals necessary to complete the work. The unit price and payment shall also include the excavation and disposal off-site of any materials deemed unsuitable for backfill. No separate measurement or payment will be made for material removed.

B. Graded Aggregate Type "B" for Undercut Excavation, measured as provided above, shall be paid for at the contract unit price per ton bid for this item, which price and payment shall constitute full compensation for supplying, installing, and compacting said materials,

including all equipment, tools, labor, and incidentals needed to complete the work. The unit price and payment shall also include the excavation and disposal off-site of any materials deemed unsuitable for fill or backfill. No separate measurement or payment will be made for material removed.

C. Geotextile Stabilization Fabric, measured as provide above, shall be paid for at the contract unit price per square foot bid for this item, which price and payment shall constitute full compensation for supplying and installing the fabric for undercut excavation, including all equipment, tools, labor, and incidentals needed to complete the work.

END OF SECTION

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SECTION 31 25 00

EROSION AND SEDIMENT CONTROLS

PART 1 GENERAL

1.01 DESCRIPTION

A. General: Provide temporary soil and sediment control measures in accordance with the Plans and Contract Documents.

1.02 QUALITY ASSURANCE

A. Standards
Except as modified by governing codes and by the Contract Documents, comply with the applicable provisions and recommendations of the following:

1. Delaware Erosion and Sediment Control Handbook.
2. Delaware Department of Transportation Standard Specifications for Highways and Bridges, dated August 2016 (hereinafter referred to as the "Standard Specifications").

B. Design Criteria

1. The primary objective of this specification is to control soil erosion to the maximum extent practicable.
2. The temporary control provisions contained herein shall be coordinated with permanent erosion control features to the extent practical to assure effective and continuous erosion control throughout the construction and post- construction period.
3. The erosion control measures described herein shall be continued until the construction is complete and all disturbed areas are fully stabilized.
4. Wherever construction exposes work which is subject to erosion, erosion control features or other work to be completed within such areas shall follow as soon after exposure as practicable.

PART 2 PRODUCTS

2.01 MATERIALS

A. Temporary mulches shall conform to Section 908 of the Delaware Department of Transportation Standard Specifications for Bridges and Highways.

B. Temporary grass mixtures shall be as shown on the Plans, or in the absence of plan information, shall conform to the Section 908 of the Standard Specifications.

C. Temporary structural Erosion Control measures shall conform to the requirements of the Delaware Erosion and Sediment Control Handbook and the Delaware Department of Transportation Standard Specifications.

D. Erosion control matting and blankets shall conform with the Delaware Erosion and Sediment Control Handbook requirements for soil stabilization matting (SSM) I and II. Matting shall be composed of 100% agricultural straw (minimum 0.5 pounds per square yard) or 100% wood excelsior fiber (0.8 pounds per square yard) with a single or double netting of either photo-degradable or bio-degradable material. SSM-I shall be North American Green S75, American Excelsior Curlex I, or approved equal. SSM-II shall be North American Green S150, American Excelsior Curlex II, or approved equal.

PART 3 EXECUTION

3.01 CONSTRUCTION REQUIREMENTS

A. Vegetative stabilization shall be used on graded or cleared areas, which are subject to erosion for a period of 14 days or more.

B. All temporary erosion control measures shall be installed in accordance with the Delaware Erosion and Sediment Control Handbook.

C. Erosion control matting shall be installed in accordance with the manufacturer's written instructions, the requirements of the Delaware Erosion and Sediment Control Handbook, and the details on the Plans.

D. In the event of conflict between these requirements and pollution control laws, rules, or regulations of other federal or state agencies, the more restrictive laws, rules, or regulations shall apply.

E. The Contractor shall be responsible for maintaining all soil erosion and sediment control measures in an acceptable and functional manner. The Contractor shall remove all temporary measures after all other construction is complete, final restorations installed, and all disturbed areas have been adequately stabilized.

END OF SECTION

SECTION 32 05 23

CONCRETE SIDEWALKS

PART 1 GENERAL

1.01 DESCRIPTION

A. Sawcut and remove existing concrete sidewalk, ramps, and pads as shown on the plan, marked in the field, or as directed by the Engineer.

B. Patch or provide new concrete sidewalk, ramps, and pads in areas designated on Plans, marked in the field, or as directed by the Engineer.

C. Place Graded Aggregate Base Course below proposed concrete sidewalks.

D. Construction accessible curb ramps with detectable warning surfaces.

E. Repair damaged concrete steps and other surfaces where indicated on the Plans.

1.02 STANDARDS

A. The quality of materials and performance of work specified in this section shall be in accordance with the Delaware Department of Transportation Standard Specifications for Road and Bridge Construction, dated August 2016, latest revision (hereinafter referred to as the "Standard Specifications").

Section 301: Graded Aggregate Base Course
Section 705: P.C.C. Sidewalk, Curb Ramps, and Sidewalk Detectable Warning System
Section 762: Saw Cutting and Butt Joints
Section 1022: Portland Cement Concrete

1.03 SUBMITTALS

A. Certificates: All deliveries of concrete shall be accompanied by delivery slips.

B. Submit concrete mixtures, source of supply, and product data in accordance with the conditions of the Contract.

1.04 ENVIRONMENTAL REQUIREMENTS

A. Allowable Concrete Temperatures

1. Cold weather: 60 degrees Fahrenheit. (18° C) when discharged from the mixer.
2. Hot weather: Maximum concrete temperature is 80 degrees Fahrenheit. (30° C).

B. Do not place concrete during rain, when atmospheric temperature is at or below 36 degrees Fahrenheit (2° C), or when conditions are otherwise unfavorable.

1.05 PROTECTION

A. Protect concrete from pedestrian and vehicular traffic until concrete has been sufficiently cured.

PART 2 PRODUCTS

2.01 MATERIALS

A. Concrete
   1. Use concrete developing a compressive strength of 3,000 p.s.i. at twenty-eight (28) days.
   2. Use air-entrained concrete.

B. Cement aggregates, water and air-entrainment methods and materials conforming to Section 1022 of the Standard Specifications.

C. Joint filler: Pre-formed expansion joint material, conforming to Section 808.06 of the Standard Specifications.

D. Curing compound: White pigmented liquid, conforming to AASHTO M 148 for Type 2, Class A or B.

E. Vapor barrier: Where called for on Plans shall be 6 mil. polyethylene.

F. Spalled areas shall be repaired with a pre-blended, pre-packaged cement based mortar requiring only the addition of potable water. The material shall not contain any chlorides or lime other than the amounts contained within the hydraulic composition. The concrete repair material shall have a minimum strength of 5000 psi after 28 days. Concrete repair material shall be as manufactured by Five Star Products, Inc., or approved equal.

G. Newly constructed concrete sidewalks shall be sealed with a concrete treating oil. The treating oil shall be a solution of boiled linseed oil and mineral spirits in accordance with ASTM D 260. Concrete treating oil shall be TK-3102, as manufactured by TK Products, or Lin-Seal, as distributed by W.R. Meadows, Inc., or approved equal.

PART 3 EXECUTION

3.01 REMOVING EXISTING SIDEWALK

A. All portions of existing concrete sidewalk to be removed shall be isolated from pavements, curb, or buildings to remain by saw cutting or by the presence of an existing expansion joint. Care shall be exercised by the Contractor to insure that no damage occurs to any elements to remain and any damage to items to remain shall be replaced or repaired by the Contractor at no additional cost to the Owner.

B. Concrete shall be broken up by an approved power breaking machine. All concrete removed shall be taken off the project site an disposed of lawfully.

3.02 PREPARATION FOR NEW SIDEWALK

A. Excavate subgrade and set forms so that finished sidewalk conforms to lines and grades shown on Plans.

B. Prepare sidewalk subgrade as specified in Section 705 of the Standard Specifications.

C. Verify that earthwork is completed to correct line and grade.

D. Verify that forms conform to line, grade and dimensions shown on Plans.

E. Check that subgrade is smooth, compacted and free of excessive moisture.

F. Do not commence work until conditions are satisfactory.

3.03 CONSTRUCTION METHODS

A. Concrete sidewalks and aprons shall be constructed in accordance with the requirements of Section 705 of the Delaware Department of Transportation Standard Specifications for Road and Bridge Construction.

B. Use vibration or tamping to consolidate the rapid set concrete patching material. Work material into saw cuts, extending beyond the corners of the repair area. Strike-off and shape the material to match the surrounding concrete.

C. Concrete treating oil shall be sprayed or rolled onto clean and dry concrete in accordance with the manufacturer's written instructions.

D. Construct accessible curb ramps in accordance with the details shown on the Plans and the requirements of Section 705.3.7 of the Standard Specifications.

END OF SECTION

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SECTION 32 12 16

ASPHALT PAVING

PART 1 GENERAL

1.01 DESCRIPTION

A. Work included: Provide labor, materials, and equipment necessary to complete the work of this Section, including but not limited to the following:
   1. Milling existing pavements.
   2. Patching pavement, including removal of existing pavement and installation of bituminous concrete base course patch.
   3. Surface preparation, and installation of bituminous concrete base course (BCBC).
   4. Surface preparation, and installation of Type B, binder course pavement, where applicable.
   5. Installation of Type C, wearing surface course for pavement patching, and for overlay of existing bituminous pavement including patched and repaired areas.
   6. Pavement markings.

1.02 STANDARDS

A. The quality of materials and performance of work specified in this section shall be in accordance with the Delaware Department of Transportation Standard Specifications for Road and Bridge Construction, dated August 2016, latest revision (hereinafter referred to as the "Standard Specifications").
   1. Section 401: Bituminous Pavement
   2. Section 402: Bituminous Paving Materials, Patching
   3. Section 760: Pavement Milling
   4. Section 817: Pavement Markings
   5. Section 1011: Tack Coat
   6. Section 1014: Asphalt Materials Production

1.03 DEFINITIONS

A. Subgrade: Surface upon which pavements will be constructed.

B. Base Course: That portion of the pavement cross section consisting of graded aggregate base course or bituminous concrete deep lift.

1.04 QUALITY ASSURANCE

A. Bituminous concrete producer shall be regularly engaged in the production of hot-mix, hot-laid bituminous concrete, and shall be approved by the Delaware Department of Transportation or the Pennsylvania Department of Transportation.

1.05 SUBMITTALS

A. Job mix formula and source of supply.

B. Provide copies of delivery slips at the end of each working day.

PART 2 PRODUCTS

2.01 GENERAL

A. Materials and mixtures shall comply with the following sections of Delaware Department of Transportation Standard Specifications. All bituminous concrete paving shall be obtained from a DelDOT approved plant.

2.02 PAVING MATERIALS AND MIXTURES

A. Graded Aggregate Base Course
   1. Materials: Section 301 and 1005.

B. Bituminous Concrete Pavement
   1. Materials: Section 401.
   2. Mixture: Section 401

C. Emulsified Asphalt: Section 1016

D. Course Aggregate: Sections 805, 813

E. Tack Coat: Meeting the requirements of Section 1011 of the Standard Specifications.

2.03 JOB MIX FORMULA REQUIREMENTS

A. Provide job mix formulas for each required bituminous concrete mixture as specified in Section 401 of the Standard Specifications.

B. Submit for approval prior to beginning paving operations.

2.04 MIX DESIGN AND CONTROL REQUIREMENTS

A. The design and control requirements for all paving mixtures shall conform to Section 401 of the Standard Specifications.

2.05 SAMPLES AND TESTING

A. Methods and rates of sampling bituminous mixtures shall conform to Section 1014 of the Standard Specifications with the following exceptions:

   1. Sampling shall be performed by the producer's quality control technician.
   2. For small scale projects where it is possible to attain the minimum lot size specified, a total of five (5) samples shall be taken at random for each type of mix specified, per each day's production.

B. Testing of bituminous concrete mixtures to determine the quantity of bitumen, gradation of aggregate, and conformance to mix design requirements shall be as specified in Section 401 of the Standard Specification.

C. Submit results of tests on forms signed by producer's quality control technician.

2.06 PREPARATION OF MIXTURES

A. The preparation of all bituminous mixtures shall conform to Section 1014 of the Standard Specifications.

2.07 PAVEMENT MARKINGS

A. All paint shall be of materials approved by the Delaware Department of Transportation per Sections 817 and 1071 of the Standard Specifications for Latex or Epoxy Paint. Glass beads will not be required for paint striping in parking lots or private driveways.

B. Thermoplastic material, where shown on the Plan or required by DelDOT, shall meet the requirements of Sections 817 and 1071 of the Standard Specifications.

PART 3 EXECUTION

3.01 GENERAL

A. The method of construction including bituminous concrete plant and equipment, bituminous concrete pavers, vehicles for transporting bituminous mixtures, rollers, and all construction methods shall conform to Section 401 of the Standard Specifications except as modified by the Supplemental Requirements below.

3.02 PAVEMENT MILLING

A. Construction methods for pavement milling shall conform to Section 760 of the Standard Specifications.

3.03 PAVEMENT PATCHING

A. Construction methods for patching pavement shall conform to Sections 401 and 406 of the Standard Specifications. A milling machine may be use for pavement and base course removal.

3.04 PROOF ROLL

A. Proof roll subgrade surfaces using heavy, rubber-tired rollers, or loaded dump truck in accordance with Section 202 of the Standard Specifications. Proof roll in the presence of the Owner’s Representative.
   1. Subgrades shall be firm and unyielding.
   2. Compact areas showing deflection and instability.

B. Notify the Engineer or the Inspector of unsatisfactory conditions.

C. Do not begin paving work until any such unsatisfactory conditions have been corrected.

3.05 SURFACE PREPARATION

A. Earth and Base Course Surface
   1. Remove loose and foreign material from compacted subgrade surface immediately before application as required.
   2. Use power broom or blowers and hand brooming as required.
   3. Do not displace subgrade material.

B. Existing Pavement Surfaces
   1. Remove loose and foreign material from existing pavement surfaces immediately before application of paving
   2. Use self-propelled mechanical sweepers. Supplement with hand brooming as required.
   3. Pay particular attention to cleaning of gutter lines and outer edges of pavement areas.
   4. Remove all weeds, grass or other vegetative matter growing in pavement areas, particularly along joints and curbs.

C. Minor Patching
   1. Existing pavement surfaces: Fill in depressions, and patch pavement in overlay areas that are not marked out for base repairs.

3.06 TACK COAT

A. Apply to cleaned surfaces of all pavements to be overlaid or slurry seal coated.

B. Apply to cleaned surfaces of newly constructed base pavement if coated with dust, dirt, foreign materials in sufficient amount to prevent bond with surface course.

C. Apply to edges of paving where base repairs are to be made.

D. Apply tack coat material at temperatures, specified in Section 401 of the Standard Specifications.

E. Apply at rate of 0.05 to 0.15 gallons per square yard immediately prior to placing pavement.

F. Apply tack coat by brush to contact surfaces of pavement cold joints, curbs, gutters, manholes, and other structures projecting into or abutting asphalt concrete pavement.

G. Allow surfaces to dry until material is in a condition of tackiness to receive pavement.

H. Take precautions to insure tack coat is not applied to exposed surfaces of curbs or other exposed surfaces. Tack coat so applied shall be removed by Contractor at no additional cost to Owner.

3.07 GENERAL SURFACE REQUIREMENTS

A. Test finished surface of each bituminous concrete course for smoothness using a ten (10) foot straightedge.

B. The straightedge shall have projections on the bottom at each end, either built-in or firmly attached, so that it is supported six (6") inches above the pavement surface at the ends. It shall be free from warp and deflection, and furnished by the Contractor without additional compensation.

C. Check surfaced areas at intervals and in directions specified.

D. Check surfaces for pavement smoothness immediately after initial compaction, and correct variations by removing or adding material as may be necessary. Then rolling shall be continued as specified.

E. Immediately after final rolling and while the pavement is still hot, the smoothness of the course shall be checked again and all projections or depressions exceeding the specified tolerances shall be corrected by removing defective work and replacing it with new surface course as specified. Portions of the surface otherwise unsatisfactory shall be replaced.

F. Finished surfaces shall be free of all roller marks, ridges and voids.

3.08 FIELD QUALITY CONTROL

A. Taking of pavement cores and testing for the determination of conformance to control air voids and pavement thickness shall be performed in accordance with Section 401 of the Standard Specifications.

B. When required per the General or Special Provisions, the Contractor shall employ and pay for the services of an Independent Testing Laboratory acceptable to the Engineer to perform additional field quality control sampling and testing when initial tests indicate work does not comply with the Contract Documents. All sampling and testing shall be performed as specified in section 401 of the Standard Specifications.

C. Areas of pavement removed for field quality control testing shall be replaced by the Contractor as follows:
   1. Clean debris from core area. Cut all exposed pavement edges vertical.
   2. Apply tack coat to exposed surfaces before installing replacement pavement.
   3. Fill core area with surface course mixture for the full depth of the core.
   4. Compact and grade mixture; seal repaired area with tack coat; and apply thin layer of sand over tack coat.

3.09 PAVEMENT MARKINGS

A. Paint equipment and installation shall conform to Section 817 of the Standard Specifications.

B. Application of Thermoplastic materials, where required, shall conform to Section 817.03.5 of the Standard Specifications.

C. All markings shall comply with the Manual on Uniform Traffic Control Devices, the Delaware Manual on Traffic Controls for Street and Highway Construction and Maintenance, the Delaware State Fire Prevention Regulations, and the Delaware State Accessibility Board.

END OF SECTION

SECTION 32 16 13
CONCRETE CURB

PART 1 GENERAL

1.01 DESCRIPTION

A. Remove and dispose off site existing concrete or bituminous curb as shown on the Plans, marked in the field, or as directed by the Engineer.

B. Install new poured Portland cement concrete curb in the locations designated on the Plans, marked in the field, or as directed by the Engineer.

1.02 STANDARDS

A. The quality of materials and performance of work specified in this section shall be in accordance with the Delaware Department of Transportation Standard Specifications for Road and Bridge Construction, dated August 2016 (hereinafter referred to as the "Standard Specifications").

Section 701: Portland Cement Concrete Curb
Section 1022: Portland Cement Concrete Production

1.03 SUBMITTALS

A. Certificates: All deliveries of concrete shall be accompanied by delivery slips.

1.04 ENVIRONMENTAL REQUIREMENTS

A. Allowable Concrete Temperatures

1. Cold weather: 60 degrees Fahrenheit. (18° C) when discharged from the mixer.
2. Hot weather: Maximum concrete temperature is 80 degrees Fahrenheit. (30° C).

B. Do not place concrete during rain, when atmospheric temperature is at or below 36 degrees Fahrenheit (2° C), or when conditions are otherwise unfavorable.

1.05 PROTECTION

A. Protect new concrete curb from traffic for a minimum of seven (7) days.

PART 2 PRODUCTS

2.01 MATERIALS

A. Concrete

1. Use concrete developing a compressive strength of 3,000 p.s.i. at twenty-eight (28) days.
2. Use air-entrained concrete.

B. Cement, aggregates, water and air-entrainment methods and materials conforming to Section 1022 of the Standard Specifications for Class B concrete.

C. Joint filler: Pre-formed expansion joint material, conforming to Section 1042 of the Standard Specifications.

D. Curing compound: White pigmented liquid, conforming to AASHTO M 148 for Type 2, Class A or B.

E. Bituminous Joint Sealant: Conforming to the requirements of section 1042 of the Standard Specifications:

PART 3 EXECUTION

3.01 PREPARATION

A. When encountered, cut existing pavements vertically with a sharp tool on a straight line prior to excavating for curb. Cut shall be made twelve inches (12”) to twenty-four inches (24”) beyond the limits of excavation, and maintained straight and neat, or re-cut and dressed as required.

B. Excavate subgrade and set forms so that finished curb conforms to required lines and grades.

C. Prepare curb subgrade as specified in Section 701 of the Standard Specifications.

D. Verify that earthwork is completed to correct line and grade.

E. Verify that forms conform to proposed line, grade and curb cross section.

F. Check that subgrade is smooth, compacted and free of frost and excessive moisture.

G. Do not commence work until conditions are satisfactory.

3.02 PERFORMANCE

A. Method of curb construction shall conform with Section 701 of the Standard Specifications

1. Install 1/2-inch wide expansion joints at equal intervals, not to exceed forty feet (40'). Install additional expansion joints where curb abuts structures, and install expansion joints or bond breaker where curb abuts sidewalk. Fill expansion joints with joint filler, 1/2-inch thick. Insert joint filler 1/4-inch from the top and face of curb.
2. Construct contraction joints (transverse joints) at 10' intervals, except where shorter sections are necessary for closures; but no section shall be less than four feet (4').

3. Finish concrete surfaces of curb to match existing adjacent curbs. Curb cross section shall be as shown on the Plans.

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END OF SECTION

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SECTION 32 90 00

PLANTING

PART 1 GENERAL

1.01 RELATED DOCUMENTS AND STANDARDS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This section includes the following:

1. Trees
2. Shrubs
3. Plants
4. Topsoil
5. Stakes and guys
6. Landscape fabric.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Section 31100: Site Clearing
2. Section 31200: Earthmoving

1.03 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product certificates signed by manufacturers certifying that their products comply with specified requirements.

1. Manufacturer's certified analysis for standard products.
2. Analysis for other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.
3. Label data substantiating that plants, trees, shrubs, and planting materials comply with specified requirements.

C. Qualification data for firms and persons to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of Engineers and owners, and other information specified.

D. Planting schedule indicating anticipated dates and locations for each type of planting and coordination with other site work for approval.

E. Maintenance instructions recommending procedures to be established by Owner for maintenance of landscaping during an entire year. Submit before expiration of required maintenance periods.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed landscaping work similar in material, design, and extent to that indicated for this Project and with a record of successful landscape establishment.

1. Installer's Field Supervision: Installer shall maintain an experienced full-time supervisor on the Project site during times that landscaping is in progress.

B. Provide quality, size, genus, species, and variety of trees and shrubs indicated on the Plans, in accordance with the applicable requirements of ANSI Z60.1 "American Standard for Nursery Stock", latest edition.

C. Landscape Architect may inspect trees either at place of growth or at site before planting, for compliance with requirements for genus, species, variety, size, and quality. Landscape Architect retains the right to further inspect trees for size and condition of balls and root systems, insects, injuries and latent defects, and to reject unsatisfactory or defective material at any time during progress of work. Contractor shall remove rejected trees from project site.

D. Do not make substitutions of plant materials. If required landscape material is not obtainable, submit proof to the Landscape Architect, together with proposal for use of equivalent material.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in containers showing weight, analysis, and name of manufacturer. Protect materials from deterioration during delivery and while stored at site.

B. Trees and Shrubs: Deliver freshly dug trees and shrubs. Do not prune before delivery, except as approved by Engineer. Protect bark, branches, and root systems from sun scald, drying, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy natural shape. Provide protective covering during delivery. Do not drop trees and shrubs during delivery.

C. Handle balled and burlapped stock by the root ball.

D. Deliver trees, shrubs, and plants after preparations for planting have been completed and install immediately. If planting is delayed more than 6 hours after delivery, set planting materials in shade, protect from weather and mechanical damage, and keep roots moist.

1. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
2. Do not remove container-grown stock from containers before time of planting.

3. Water root systems of trees and shrubs stored on site with a fine-mist spray. Water as often as necessary to maintain root systems in a moist condition.

1.06 PROJECT CONDITIONS

A. Utilities: Determine location of above grade and underground utilities and perform work in a manner which will avoid damage. Hand excavate, as required. Maintain grade stakes until removal is mutually agreed upon by parties concerned. The Contractor shall be responsible for the location and protection of all utilities and for repair of any utilities damaged by Contractor's work.

B. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify Landscape Architect before planting.

1.07 COORDINATION AND SCHEDULING

A. Coordinate installation of planting materials during normal planting seasons for each type of plant material required.

1.08 PLANT MATERIAL QUANTITIES

A. Quantities on the plant list are approximate, the Contractor shall supply plants in quantities as shown on the drawings.

1.09 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Warranty: Warrant the following living planting materials for a period of two years after date of Substantial Completion, against defects including death and unsatisfactory growth, except for defects resulting from neglect or abuse by Owner, abnormal weather conditions unusual for warranty period, or incidents that are beyond Contractor's control.

1. Trees.
2. Shrubs.
3. Plants.

C. Remove and replace dead planting materials immediately unless required to plant in the succeeding planting season.

D. All replacements shall be plants of the same kind, size, and quality as originally specified.

E. Replace planting materials that are more than 25 percent dead or in an unhealthy condition at end of warranty period.

F. Replaced plants shall be furnished, planted, mulched, and watered as part of the warranty.

G. A limit of one replacement of each plant material will be required, except for losses or replacements due to failure to comply with requirements.

1.10 TREE AND SHRUB MAINTENANCE

A. Maintain trees and shrubs by pruning, cultivating, watering, weeding, fertilizing, restoring planting saucers, tightening and repairing stakes and guy supports, and resetting to proper grades or vertical position, as required to establish healthy, viable plantings. Spray as required to keep trees and shrubs free of insects and disease. Maintain trees and shrubs for the following period.

1. Maintain trees and shrubs until condition is approved by Landscape Architect and Owner, and Owner has reviewed and accepted maintenance instructions provided by the Contractor.

PART 2 PRODUCTS

2.01 GENERAL

A. Furnish nursery-grown trees and shrubs conforming to ANSI Z60.1, with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock free of disease, insects, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurements.

B. Provide trees and shrubs of sizes and grades conforming to ANSI Z60.1 for type of trees and shrubs required. Trees and shrubs of a larger size may be used if acceptable to Engineer with a proportionate increase in size of roots or balls.

C. Label at least one (1) tree and shrub of each variety and caliper with a securely attached, waterproof tag bearing legible designation of botanical and common name.

2.02 SHADE AND FLOWERING TREES

A. Shade trees: Single-stem trees with straight trunk, well-balanced crown, and intact leader, free of branches to about 50% of their height, of height and caliper indicated, conforming to ANSI Z70.1 for type of trees required.

B. Small trees: Small upright or spreading type, branched or pruned naturally according to species and type, and with relationship of caliper, height, and branching recommended by ANSI Z60.1.

C. Provide balled and burlapped trees except where indicated.

1. Container-grown trees will be accepted in lieu of balled and burlapped trees subject to meeting ANSI Z60.1 limitations for container stock.

2.03 DECIDUOUS SHRUBS

A. Form and Size: Deciduous shrubs with not less than the minimum number of canes required by and measured according to ANSI Z60.1 for type, shape and height of shrubs.

B. Provide balled and burlapped trees except where indicated.

1. Container-grown trees will be acceptable in lieu of balled and burlapped deciduous trees subject to meeting ANSI Z60.1 limitations for container stocks.

2.04 CONIFEROUS EVERGREENS

A. Form and Size: Normal-quality, well-balanced, coniferous evergreens, of type, height, spread, and shape required, conforming to ANSI Z60.1

B. Provide balled and burlapped coniferous evergreens.

1. Container-grown coniferous evergreens will be acceptable in lieu of balled and burlapped coniferous evergreens subjected to meeting ANSI Z60.1 limitations for container stock.

2.05 BROADLEAF EVERGREENS

A. Form and size: Normal-quality, well-balanced, broadleaf evergreens, of type, height, spread, and shape required, conforming to ANSI Z60.1.

B. Provide balled and burlapped broadleaf evergreens.

1. Container-grown broadleaf evergreens will be acceptable in lieu of balled and burlapped broadleaf evergreens subject to meeting ANSI Z60.1 limitations for container stock.

2.06 REQUIREMENTS FOR BALLED AND BURLAPPED STOCK

A. Where indicated to be balled and burlapped, provide trees dug with firm, natural ball of earth in which they are grown free of noxious weed matter.

B. Provide ball size of not less than diameter and depth recommended by ANSI Z60.1 for type and size of tree required. Increase ball size or modify ratio of depth to diameter as required to encompass fibrous and feeding root system necessary for full recovery of trees subject to unusual or non-typical conditions of growth, soil conditions or horticultural practice.

C. No balled and burlapped plant will be accepted if the ball is cracked or broken either before or during the process of planting.

D. Wrap and tie earth ball as recommended by ANSI Z60.1 for size of balls required. Drum-lace balls with a diameter of 30" or greater.

2.07 TOPSOIL AND BACKFILL

A. Topsoil shall be as specified in Section 312000 of these Specifications.

B. Backfill in planting holes shall be as specified on the Plans.

2.08 MULCH

A. Mulch shall be double shredded, hardwood bark, uniform in size and free of foreign matter.

2.09 STAKES AND GUYS

A. Upright and Guy Stakes: Rough-sawn, sound, new hardwood, redwood, or pressure-preservative-treated softwood, free of knots, holes, cross gain, and other defects, 2 by 2 inches (50 by 50 mm) by length indicated, pointed at one end.

B. Flexible strapping: ASTM A-641 (ASTM A 641 M), Class 1, galvanized-steel wire, 2-strand, twisted, 0.106 inch (2.7 mm) in diameter.

C. Hose Chafing Guard: Reinforced rubber or plastic hose at least 2 inch (13 mm) in diameter, black, cut to lengths required to protect tree trunks from damage.

2.10 LANDSCAPE FABRIC

A. Provide landscape fabric for planting beds where designated on the Plans. Landscape fabric shall be 100% spunbonded polypropylene with UV inhibitors. The fabric shall have a minimum unit weight of 1.9 ounces per square yard, a minimum tensile strength of 73 pounds, and a minimum puncture strength of 23 pounds. Fabric shall be black have a minimum permittivity of 3.0 sec^{-1}. Landscape fabric shall be Typar Professional Landscape Fabric, or approved equal.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas to receive landscaping for compliance with requirements and for conditions affecting performance of work of this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 EXCAVATION FOR TREES AND SHRUBS

A. Pits and Trenches: Excavate with vertical sides. Loosen hard subsoil in bottom of excavation.

1. Balled and Burlapped Trees and Shrubs: Approximately 3 times as wide as ball diameter and equal to ball depth.
2. Container-Grown Trees and Shrubs: Loosen and mix soil with rototiller or shovel.

B. Obstructions: Notify Engineer if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.

C. Drainage: Notify Engineer if subsoil conditions evidence unexpected water seepage or retention in tree or shrub pits.

3.03 PLANTING TREES AND SHRUBS

A. Set balled and burlapped stock plumb and in center of pit or trench with top of ball raised above adjacent finish grades as indicated.

1. Place stock on undisturbed subgrade.
2. Remove burlap and wire baskets from tops of balls and from sides, but do not remove from under balls. Remove pallets, if any, before setting.
3. Place soil around ball in layers, tamping to settle backfill and eliminate voids and air pockets. When pit is approximately 2 backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more is absorbed. Water again after placing and tamping final layer of backfill.

B. Set container-grown stock plumb and in center of pit or trench with top of ball raised above adjacent finish grades as indicated.

1. Carefully remove containers so as not to damage root balls.
2. Place stock on undisturbed subgrade.
3. Place soil around ball in layers, tamping to settle backfill and eliminate voids and air pockets. When pit is approximately backfilled, water thoroughly before placing remainder of backfill.

C. Dish and tamp top of backfill to form a 3-inch (75-mm) high mound around the rim of the pit. Do not cover top of root ball with soil.

3.04 TREE AND SHRUB PRUNING

A. Prune, thin, and shape new trees and shrubs according to standard horticultural practice. Prune trees to retain required height and spread. Unless otherwise directed by Engineer, do not cut tree leaders; remove only injured or dead branches from flowering trees. Prune shrubs to retain natural character. Shrub sizes indicated are size after pruning.

3.05 TREE AND SHRUB GUYING AND STAKING

A. Guying and Staking: Guy and stake trees exceeding 14 feet (4.2 m) and more than 3-inch (75-mm) caliper unless otherwise indicated. Securely attach no fewer than 3 guys to stakes 30-inches (760 mm) long, driven to grade. Attach flags to each guy wire, 30 inches (760 mm) above finish grade.

B. Contractor shall remove stakes 4 to 6 months after planting.

3.06 CLEANUP AND PROTECTION

A. During landscaping, keep pavements clean and work area in an orderly condition.

B. Protect landscaping from damage due to landscape operations, operations by other contractors and trades, and trespassers. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged landscape work as directed.

3.07 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of it off the Owner's property and in accordance with the environmental specifications.

END OF SECTION

SECTION 32 92 00

TURF AND GRASSES

PART 1 GENERAL

1.01 DESCRIPTION

A. Provide lime and permanent seed mixture in the areas shown on the plans for:
   1. Restoration of existing grass areas disturbed by Contractor's operations
   2. Stabilization of unpaved areas.

1.02 STANDARDS

A. The quality of materials and performance of work specified in this section shall be in accordance with the Delaware Department of Transportation Standard Specifications for Road and Bridge Construction, dated August 2016, latest revision (hereinafter referred to as the "Standard Specifications").
   1. Section 908: Soil Stabilization Practices

1.03 SUBMITTALS

A. Certificates
   1. Seed producer's certified analysis of composition, purity, and germination of seed mixture, dated within nine (9) months of sowing.
   2. Manufacturer's certified chemical and physical composition analysis for ground limestone.

B. Delivery Slips
   1. Accompany each delivery of seed, ground limestone, and fertilizer with delivery slip showing the product weight.

C. Test Reports
   1. Submit results of test report for pH analysis of soil, and when ground limestone is required, the total amount of magnesium and calcium oxides required.

1.04 SUBMITTALS

A. Submit product data for seed and for sod, including mix components stating the botanical and common name and percentage by weight of each species and variety, and percentage purity, germination, and weed seed. Identify the source and supplier of seed and turfgrass sod.

B. Deliver all materials in accordance with manufacturer's printed instructions, and in such manner as to protect from moisture.

C. Store and handle material in accordance with manufacturer's printed instructions, and in such manner as to protect from moisture.

1.05 JOB CONDITIONS

A. Existing Conditions: Perform seeding only after preceding work affecting found surface is completed.

B. Environmental Requirements
   1. Plant seed on unfrozen soil. Soil shall be in friable condition at the time of seeding.
   2. Do not perform seeding when wind exceeds 15 mph.
   3. Do not seed between October 15th and March 1st.

C. Protection: Restrict pedestrian and vehicular traffic from seeded areas after planting to end of the establishment period.

PART 2 PRODUCTS

2.01 SEED MIXTURE

A. Seed mixture shall be as shown on the Plans or, if not shown on the Plans, shall be as specified in Section 908 of the Standard Specifications for Permanent Grass Seeding – Subdivision.

B. Use clean, dry, new crop seed. Use certified seed when available.

2.02 TOPSOIL

A. Topsoil shall conform to Section 0312000 of these Specifications and Section 908 of the Standard Specifications.

2.03 GROUND LIMESTONE

A. Limestone shall be ground agricultural grade conforming to Section 908 of the Standard Specifications.

2.04 MULCH

A. Straw mulch shall be unrotted small grain straw, shall be relatively free of weeds, and shall be free of noxious weeds such as thistles, Johnsongrass, and quackgrass.

B. Hydraulically Applied Mulch
   1. Wood fiber mulch shall consist of specially prepared wood that has been processed to a uniform state, is packaged for sale as a hydraulic mulch for use with hydraulic seeding equipment, and consists of a minimum of 70% virgin or recycled wood fiber combined with 30% paper fiber and additives.
   2. Blended fiber mulch shall consist of any hydraulic mulch that contains greater than 30% paper fiber. The paper shall be processed to a uniform fibrous state and packaged for sale as a hydraulic mulch for use with hydraulic seeding equipment.
   3. A bonded fiber matrix (BFM) shall consist of long strand, specially prepared wood fibers that have been processed to a uniform state held together by a water resistant bonding

agent. BFM's shall contain no paper, but may contain shall percentages of synthetic fibers to enhance performance.

4. All components of the hydraulically applied mulches shall be pre-packaged by the manufacturer to assure material performance.

C. Erosion control blankets and turf reinforcement matting shall be as shown on the Plans, or if not shown on the Plans, shall meet the requirements of Section 312500 of these Specifications and Section 908 of the Standard Specifications.

PART 3 EXECUTION

3.01 PREPARATION

A. Check that clearing, soil preparation and preceding work affecting ground surface is completed.

B. Verify that soil is unfrozen and within allowable moisture content.

C. Do not start until conditions are satisfactory.

D. When soil to be seeded has a pH value of less than 5.8, evenly spread ground limestone, which is dry and free flowing, over area to be seeded at rate that will change soil pH value to 6.5. Thoroughly mix limestone into upper 3 to 4 inches of soil by discing, harrowing, or other approved method.

E. Water dry soil at least 24 hours prior to seeding to obtain a loose friable seed bed.

F. Before applying seed, remove all stones, rocks, lumps, roots, wires, clods, and other objects measuring 1 inch or larger in any dimension.

3.02 APPLICATION

A. Broadcast half of seed with mechanical seeder.

B. Broadcast remaining half of seed at right angles to first seeding pattern, using same broadcast method.

C. Apply seed at the rate specified in the Standard Specifications.

D. Cover seed to depth of 1/8 inch by raking or other approved method.

E. Roll seeded area with roller weighing maximum of 150 pounds per foot of width.

F. Water seeded area until water penetrates to a depth of 3 to 4 inches.

3.03 PROTECTION

A. Erect temporary signs and barriers to protect seeded areas from pedestrian and vehicular traffic.

3.04 LAWN ESTABLISHMENT

A. Watering
   1. Keep soil moist during seed germination period. and during lawn establishment.
   2. Method of watering shall provide equal distribution and coverage to all areas seeded.
   3. Continue watering during establishment period to promote healthy grass stand.

B. Re-lime and reseed all seeded areas which become eroded or otherwise disturbed; or which require mowing of weedy areas in order to establish acceptable turf.

C. Re-lime, and reseed spots larger than one square foot not having uniform stand of grass practically weed free, and not containing plants in reasonable proportion to the various kinds of seed in the grass seed mixture.

D. Perform all lawn establishment work in accordance with the specifications without additional compensation.

E. Maintain seeded areas until grass is well established and exhibits vigorous growing condition for a minimum of two cuttings. Maintain grass height of three inches. Do not cut more than one third of the grass blade at each mowing. Perform first mowing when seedling are approximately four inches long.

F. Establishment and maintenance period to extend until acceptance of the project.

3.05 CLEANING

A. Immediately clean spills on paved and finished surface areas.

B. Remove debris and excess materials from project site.

C. Dispose of protective barricades and warning signs at termination of lawn establishment period.

3.06 MULCHING

A. Straw mulch shall be applied at the rate of 70 to 90 pounds per 1,000 square feet.

B. Hydraulically Applied Mulch
   1. Hydraulic mulches shall be applied with a viable seed and at the manufacturer's recommended rates.
   2. Apply the product to stable slopes. Do not apply to saturated soils or if precipitation is anticipated with twenty-four hours.
   3. Minimum curing temperature is forty degrees (40ºF).

C. Mulch shall be anchored immediately following application by crimping or tracking, or through the use of biodegradable netting or erosion control blankets.

3.07 FIELD QUALITY CONTROL

A. The Contractor shall pay for testing and related costs when materials are found no to be in conformance with this specification.

B. Seed sampling and testing shall be conducted in accordance with Delaware Code and with the rules and regulations for testing seed adopted by the Association of Official Seed Analysis.

END OF SECTION

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SECTION 33 11 00

WATER UTILITY PIPING

PART 1 GENERAL

1.01 DESCRIPTION

A. Furnish and install Ductile Iron water pipe, fittings, and appurtenances as shown on the Plans and described herein.

B. Furnish and install P.V.C. water pipe, fittings, and appurtenances as shown on the Plans and described herein.

C. Furnish and install copper water tubing for service connections under three-inches in diameter.

D. All water mains, fittings, taps, valves, and fire hydrants shall be supplied, installed, disinfected, and tested in accordance with the requirements of the Suez Water and the Delaware Department of Health.

E. Coordinate with the Suez Water for service connections and to determine the scope of services to be performed by Suez Water.

F. Related work specified elsewhere includes:

Section 0312000: Earthwork

1.02 STANDARDS

A. Suez Water Standards and Specifications.

B. American Water Works Association
1. AWWA C900
2. AWWA C151
3. AWWA C104
4. AWWA C110
5. AWWA C111

1.03 SUBMITTALS

A. All pipe and fittings shall be inspected and tested at place of manufacture as required by the AWWA standards referenced in the specification. Provide the Engineer with two copies of certifications from each manufacturer stating the product was inspected as required, and that the test results comply with AWWA standards.

B. Submit manufacturers' product data for pipe, fittings, valves, hydrants, and gaskets.

C. All manufacturers shall validate other than by certification, the ductility of each length of pipe by an Underwriters Laboratory approved method. All P.V.C. pipe is to have Underwriters Laboratory approval.

PART 2 PRODUCTS

2.01 MATERIALS

A. Polyvinyl Chloride Pipe
   1. Water mains shall conform to AWWA C900, Class 150.
   2. P.V.C. services shall conform to ASTM-2241 for SDR 21, unless otherwise approved by the Water Company or Engineer.

B. Joints for P.V.C. Pipe: Integral-bell push-on joints except where mechanical joints are necessary to change pipe material.

C. Ductile Iron Pipe
   1. Shall conform to AWWA C-151, Class 52, and shall be manufactured in eighteen or twenty foot nominal lengths.
   2. All ductile iron pipe for water mains shall be cement-lined, 1/8-inch thick, in accordance with AWWA C104 and seal coated inside.
   3. Use Push-on joints, conforming to AWWA C151 and AWWA C111, except where mechanical joints are indicated on the Plans.

D. Pipe Fittings
   1. Shall be ductile iron fittings conforming to AWWA C110, with minimum pressure rating of 250 p.s.i.
   2. Fittings shall be cement-lined, 1/8-inch thick, in accordance with AWWA C104 and seal-coated inside.
   3. Fittings shall have mechanical joints.

E. All water valves, valve boxes, and fire hydrants shall meet the requirements of Suez Water and the Delaware Department of Health.

F. Seamless copper tubing shall be type “K” in conformance with ASTM B-88 and ANSI/NSF 61. Valves and fittings shall be in conformance with AWWA C800.

PART 3 EXECUTION

3.01 INSPECTION AND QUALITY OF PIPE

A. Before being lowered into the trench, each pipe shall be carefully inspected, and those not meeting the Specifications shall be rejected and either destroyed or removed from the work within ten (10) hours. No pipe shall be laid except in the presence of the Owner’s designated representative. The Owner’s designated representative may order the removal and relaying of any pipe not so laid.

B. The Contractor shall carefully examine all pipe and special castings before placing the same in the trench. Any pieces which are broken or show evidence of cracks or fractures shall be

rejected by the Contractor. Such inspection shall carry with it the responsibility on the part of the Contractor for the removal at the Contractor's own expense of all pipe, special castings, and appurtenances, incorporated in the work, and which under test are found to be cracked or otherwise defective.

3.02 INSTALLATION

A. Excavation and backfill for pipes shall conform to Specification Section 02200 - Earthwork and shall be as shown on the Plans.

B. All piping shall be installed in a neat and workmanlike manner. All piping shall be installed to accurate lines and grades and shall be supported as shown, specified, or necessary. Where temporary supports are used, they shall be sufficiently rigid to prevent shifting or distortion of the pipe. Suitable provision shall be made for expansion where necessary.

C. No defective pipe or fitting shall be laid or placed in the piping, and any piece discovered to be defective after having been laid shall be removed and replaced by a sound and satisfactory piece by the Contractor at the Contractor's own expense.

D. Every pipe and fitting shall be cleared of all dirt and other debris before being installed and shall be kept clean until accepted in the completed work.

E. No pipes shall be laid in fill or other unsuitable material, in a wet trench, or in the same trench with another pipe or other utility unless so noted on the drawings. A minimum eighteen inch (18") clearance shall be maintained between the outside surface of pipe and outside surface of other existing pipes and structures. When this clearance cannot be maintained, contact the Engineer for instructions prior to proceeding with the pipe installation.

F. No direct contact between pipes and structures at crossings will be permitted. Pipes in place shall not be worked over or walked on until covered by backfill well tamped in place to a depth of twelve inches over the pipe.

G. Minimum cover over water mains shall be three and one half feet (3-½').

H. The interior of all pipes shall be thoroughly cleaned of all foreign material before being lowered into trench. Pipes shall be kept clean during laying operations by means of plugs or other approved methods.

I. Gas, storm sewer, and sanitary sewer lines shall have right-of-way and water mains shall be installed to avoid the same. If conflicts occur between proposed water lines and other utilities, the water lines shall be dropped below the conflicting utility to attain the proper clearance.

J. Brace all plugs as required to prevent leakage or blowout during testing.

K. All newly placed pipes shall be pressure tested, sterilized, and cleaned in accordance with Suez Water, the Delaware Department of Health, and NFPA Standards and Specifications.

3.03 PIPING SUPPORTS

A. The Contractor shall furnish and install all supports necessary to hold the piping and appurtenances in a firm, substantial manner at the lines and grades indicated on the drawings or specified. Bends, tees, and other fittings buried in the ground shall be backed up with concrete placed against undisturbed earth where firm support can be obtained. If the soil does not provide firm support, then suitable bridle rods, clamps, and accessories to brace the fitting properly shall be provided. Such bridle rods, etc., shall be coated thoroughly with an approved bituminous paint after assembly, or, if necessary, before assembly. This work shall include bracing plugs to prevent leakage or blowout during testing.

3.04 HANDLING AND CUTTING PIPE

A. Handle and lay pipe and fittings to avoid damage to the pipe, scratching or marring machined surfaces, and abrasion of the coating or lining. Pipe cuts shall be made using an abrasive wheel, rotary wheel cutter, guillotine pipe saw, milling wheel saw, or other method approved by the Engineer. Grind cut ends and rough edges smooth. For push-on connections, bevel cut all ends.

3.05 ASSEMBLING PIPE

A. Clean ring groove and bell socket prior to inserting rubber gasket seal. Properly seat gasket; make sure it faces proper direction.

B. Clean bell and spigot ends of pipe. Lubricate spigot end of pipe and rubber gasket.

C. Hold pipe securely and in proper alignment when joining.

D. Join pipe so that reference mark on spigot end, if provided by manufacturer, is flush with end of bell.

E. Join pipe in strict accordance with manufacturer’s printed installation procedures.

F. General Procedure for Joining PVC Pipe
   1. Join pipe up to twenty-four inches in diameter when installed on non-granular and firm bedding, by means of a bar and wood block or use mechanical pipe pullers.
   2. Do not use excavating equipment to force pipe Sections together.
   3. Hold pipe securely and in proper alignment when joining.
   4. Do not disturb previously made joints. Check completed piping to assure joints are intact. Insure backfilling is accomplished without disturbing pipe.
   5. Do not allow earth, stones, or other debris to enter pipe or end section.

3.06 PROTECTION

A. Protect all finished work. Joints once made and disturbed shall be subjected to immediate rejection. It shall therefore be the duty of the Contractor to avoid the slightest movement in

completed work, while in the act of laying the pipe, in backfilling, or in the passage of workmen up and down the trench. At all times during which pipe is not being laid, the end of the pipe shall be sealed with a tight fitting plug. In no case will the drainage of trench water through a completed pipe be permitted.

B. All curves, bends, tees, hydrants and ends of pipe shall be securely blocked with socket clamps, yokes, or concrete blocking to prevent movement. At the end of a line or turn, where provision has been made for future extension or connections, fittings shall be furnished with lugs and anchored by means of socket clamps or yokes.

3.07 ADAPTORS

A. When it is necessary to join pipes of different types the Contractor shall furnish and install the necessary adaptors. Adaptors shall have ends conforming to the above Specifications for the appropriate type of joint to receive the adjoining pipe. When adaptors join two classes of pipe, the adaptors may be the lighter class.

3.08 CLEANING AND TESTING

A. All waterlines shall be fully cleaned, disinfected, and tested in accordance with Suez Water and the Delaware Department of Health standards and requirements, or the NFPA standards in the case of fire system lines, before being accepted by the Owner.

END OF SECTION

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SECTION 33 31 00

SANITARY SEWERAGE

PART 1 GENERAL

1.01 DESCRIPTION

A. Furnish and install polyvinyl chloride (PVC) gravity sewer and appurtenances as shown on the Plans and described herein.

B. Furnish and install ductile iron (DI) sanitary sewer pipe and appurtenances as shown on the Plans and described herein.

C. Furnish and install manholes, connect existing pipes to manholes, and connect proposed pipes to existing manholes where shown on the Plans or as directed by the Engineer.

D. Adjust manhole tops as shown on the Plans.

1.02 STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM D-2241: Polyvinyl Chloride (PVC) Pressure-Rated Pipe.
2. ASTM 1785: Schedule 40 Polyvinyl Chloride (PVC) pipe.

B. New Castle County Department of Special Services Standards and Specifications

1.03 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Storage and Materials
1. Store materials to prevent physical damage.
2. Store pipe and fittings off ground to prevent dirt and debris from entering.
3. Store flexible gasket materials and joint primer or adhesive compounds in cool dry place. Keep rubber gaskets clean, away from oil, grease, excessive heat, and out of direct sunlight.

B. Handling of Materials
1. Protect materials during transportation and installation to avoid physical damage.
2. Do not install out-of-round pipe.
3. Unload pipe to prevent abrasion.
4. Do not drag or push pipe while handling or distributing on project site.

1.04 SUBMITTALS

A. Submit manufacturer’s product data for all pipe, fittings, gaskets, and appurtenances.

B. Submit shop drawings for all manholes.

PART 2 PRODUCTS

2.01 MATERIALS

A. P.V.C. Pipe and Fittings
   1. ASTM D-2241; SDR 26 and 21.
   2. ASTM 1785, Schedule 40

B. Ductile Iron Pipe

   1. Shall conform to AWWA C-151, and shall be manufactured in eighteen or twenty foot nominal lengths.
   2. Use push-on joints, conforming to AWWA C151 and AWWA C11, except for fittings or where mechanical or restrained joints are indicated on the Plans.

C. All manholes shall be precast Portland cement concrete (p.c.c.) and shall conform with the New Castle County Department of Special Services standards and details. Precast manholes shall conform with ASTM C-478 except where noted on the Plans.

PART 3 EXECUTION

3.01 MATERIAL INSPECTION

A. The following information shall be clearly marked on each pipe section of P.V.C. pipe:
   1. Pipe type and SDR number.
   2. Nominal pipe size.
   3. The PVC cell classification.
   4. Name or trademark of manufacturer.
   5. The ASTM Specification designation.

B. P.V.C. Fittings shall have the following markings:
   1. The ASTM Specification designation.
   2. Manufacturer's name or trademark.
   3. Nominal size.
   4. The material designation.

C. Inspect pipe for defects prior to placement in trench. The pipe and fittings shall be free from visible cracks, holes, foreign inclusions or other injurious defects.

D. Assure that all materials are of the type specified and are not defective. Unmarked pipe or pipe and materials not meeting Specifications requirements shall be removed from the site as directed by the Engineer.

3.02 INSTALLATION

A. Fine grade trench bottom so that pipe is supported for its full length.

B. Install piping beginning at the low point of the system, true to grades and alignment indicated on the Plans. Place the bell ends of the pipe facing upstream.

C. Do not lay pipe on unsuitable material, in wet trench, or in same trench with another pipe or utility.

D. General Procedure for Joining Pipe
Do not use excavating equipment to force pipe sections together.
1. Hold pipe securely and in proper alignment when joining.
2. Do not disturb previously made joints. Check completed piping to assure joints are intact. Insure placement of backfill over pipe is accomplished without disturbing pipe position.
3. Do not allow earth, stones, or other debris to enter pipe or fittings.
5. Method of installing joint materials and joining piping shall be in strict accordance with manufacturer's printed instructions.

E. Sanitary sewer pipe shall be installed in accordance with the requirements of the New Castle County Department of Special Services.

3.03 BACKFILL AND COMPACTION

A. Bedding and Initial Backfill
1. Bedding and initial backfill shall be in accordance with the manufacturer’s written instruction or, in absence of said instructions, in accordance with Section 31200 of these Specifications.
2. Install initial backfill material as shown on the Plan details for the type of pipe being used.
3. When required, material shall be placed under the pipe haunch to provide adequate side support. Material shall be installed for entire trench width and shall be tamped and rodded to insure full contact with pipe at haunch up to the spring line.
4. Little or no tamping of the initial backfill directly over the pipe shall be done.

B. Final Backfill
1. Final backfill shall be in accordance with Section 312000 of these Specifications.

3.04 TESTING

A. All testing shall be in accordance with the requirements of the New Castle County Department of Special Services.

B. Deflection Testing – PVC Sanitary Sewer Pipe
1. All testing shall be in accordance with the requirements of the New Castle County Department of Special Services requirements.
2. For pipe conforming to the requirements of ASTM D-3034, the maximum allowable pipe deflection (reduction in vertical diameter) shall be 7-1/2%.
3. For pipe conforming to the requirements of ASTM D-2241, the maximum allowable pipe deflection (reduction in vertical inside diameter) shall be 5%.
4. Deflection tests shall be successfully performed on the complete installation by means of one of the following methods prior to the acceptance of construction.

a. “Go-No-Go” mandrel properly sized
b. Calibrated television.

C. Lamping

1. Sewer lines shall meet the following standards to pass the lamping inspection:
   a. The barrel of the pipe shall have no vertical deflection and at least seventy-five percent of the barrel shall be visible in the horizontal direction.
   b. Pipe not meeting this Specification shall be re-laid and re-lamped until compliance is achieved at no additional cost to the Owner.

D. Low Pressure Air Test

1. All gravity sanitary sewer lines shall be air tested in accordance with the requirements of the New Castle County Department of Special Services.
2. The drop in pressure during the prescribed test time shall not exceed 0.5 psi, from 3.5 to 3.0 psi testing pressure. A drop in pressure below 3.0 psi shall indicate a failure of the test.

3.05 MANHOLES

A. Manholes shall be installed in accordance with the requirements of the New Castle County Department of Special Services.

B. Installation of rubber gaskets for precast catch basins and manholes shall be in accordance with the manufacturer's recommendations.

C. Frames shall be well bedded in mortar, making a watertight joint. Cover and frame shall have a shop coat of asphaltic pitch and shall have a field coat of similar paint after the frame is set in final position.

D. Repair and adjustment of manholes shall be in accordance with the requirements of the New Castle County Department of Special Services and Section 602 of the Delaware Department of Transportation Standard Specifications for Road and Bridge Construction.

END OF SECTION

SECTION 33 41 00

STORM DRAINAGE

PART 1 GENERAL

1.01 DESCRIPTION

A. Furnish and install polyvinyl chloride (PVC) storm pipe and appurtenances as shown on the Plans and described herein.

B. Furnish and install high density polyethylene (PE) gravity storm sewer pipe and appurtenances as shown on the plans and described herein.

C. Furnish and install reinforced concrete (RC) storm sewer pipe and appurtenances as shown on the Plans and described herein.

D. Furnish and install catch basins, manholes, and yard drains. Connect existing pipes to manholes or catch basins, and connect proposed pipes to existing manholes or catch basins where shown on the Plans or as directed by the Engineer.

E. Repair and adjust catch basins and catch basin tops as shown on the Plans.

1.02 STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM D-2241: Polyvinyl Chloride (PVC) Pressure-Rated Pipe.
2. ASTM 1785: Schedule 40 Polyvinyl Chloride (PVC) pipe.
3. ASTM C-76: Reinforced Concrete Culvert Storm Drain and Sewer Pipe
4. ASTM C-443: Joints for Circular Concrete Sewer and Culvert Pipe

B. Delaware Department of Transportation Standard Specifications for Road and Bridge Construction, dated August 2016, latest revision:
1. Section 601: Pipe Culverts
2. Section 602: Drainage Structures
3. Section 1022: Portland Cement Concrete
4. Section 1031: Pipe Culverts

1.03 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Storage and Materials
1. Store materials to prevent physical damage.
2. Store pipe and fittings off ground to prevent dirt and debris from entering.
3. Store flexible gasket materials and joint primer or adhesive compounds in cool dry place. Keep rubber gaskets clean, away from oil, grease, excessive heat, and out of direct sunlight.

B. Handling of Materials
   1. Protect materials during transportation and installation to avoid physical damage.
   2. Do not install out-of-round pipe.
   3. Unload pipe to prevent abrasion.
   4. Do not drag or push pipe while handling or distributing on project site.

1.04 SUBMITTALS

A. Submit manufacturer's product data for all pipe, fittings, gaskets, and appurtenances.

B. Submit shop drawings for all catch basins, manholes, and yard drains.

PART 2 PRODUCTS

2.01 MATERIALS

A. P.V.C. Pipe and Fittings
   1. ASTM D-2241; SDR 26.
   2. ASTM 1785, Schedule 40

B. High Density Polyethylene Pipe and Fittings.
   1. All polyethylene pipe 12-inches or larger in diameter shall have a corrugated outer wall and an integrally formed smooth interior, and shall meet AASHTO M294 and DelDOT Specifications Sections 601 and 1031 for Type "S" high density polyethylene pipe.
   2. Pipes, couplings, and fittings shall be meet the requirements of AASHTO M294, modified as follows: Minimum pipe stiffness shall be 35 psi at 5% deflection and 30 psi at 10% deflection, when tested in accordance with ASTM D-2412.
   3. Pipe joints shall be soil-tight or water-tight.
   4. Pipe shall be "N-12" as manufactured by Advanced Drainage Systems, Inc. (ADS), "Sure-Lok", as manufactured by Hancor, or approved equal.
   5. Corrugated polyethylene pipe smaller than 12 inches in diameter shall have a single corrugated wall with annular interior and exterior corrugations. Pipe and fittings shall meet the requirements of AASHTO M252. Pipe joints shall be by cleated bell, split, internal and snap couplers, and shall be soil tight. Pipe shall be as manufactured by Advanced Drainage Systems, Hancor, or approved equal.

C. Reinforced Concrete Pipe

   1. Reinforced Concrete Pipe shall conform to the requirements of Sections 601 and 1031 of the Standard Specifications. All Reinforced Concrete Pipe shall conform to ASTM C-76, Class III or IV.
   2. Joint design for round reinforced concrete pipe and fittings shall conform to AASHTO C-443. Conic surface of spigot or tongue shall be designed to properly contain and seat the gasket, or gasket shall be designed so that it is properly contained and seated on conic surface of spigot or tongue.

3. Joint Material shall be flexible rubber gaskets, meeting the criteria of ASTM C-443. Joint material primer or adhesive shall be as provided or specified by pipe manufacturer.

D. All catch basins and manholes shall be precast or cast-in-place Portland cement concrete (p.c.c.) and shall conform to Section 602 of the Standard Specifications. Precast manholes shall conform with ASTM C-478, except where noted on the Plan.

E. Yard drains shall be "In-Line Drains," as manufactured by Nyloplast-ADS, or approved equal. Drains shall be made from PVC pipe, utilizing a thermo-molding process to re-form the pipe stock to the specified configuration. Joint tightness shall conform to ASTM D3212. Grates shall be ductile iron, of the same manufacturer as the yard drain, and made specifically for the supplied yard drain.

PART 3 EXECUTION

3.01 MATERIAL INSPECTION

A. The following information shall be clearly marked on each pipe section of P.V.C. pipe:
1. Pipe type and SDR number.
2. Nominal pipe size.
3. The PVC cell classification.
4. Name or trademark of manufacturer.
5. The ASTM Specification designation.

B. P.V.C. Fittings shall have the following markings:
1. The ASTM Specification designation.
2. Manufacturer's name or trademark.
3. Nominal size.
4. The material designation.

C. Polyethylene pipe shall be marked with the pipe class, date of manufacture, and the name or trademark of the manufacturer.

D. The following information shall be clearly marked on each section of reinforced concrete pipe.:
1. The ASTM Specification designation.
2. Pipe class or strength designation
3. Date of manufacture.
4. Name or trademark of manufacturer.
5. For reinforced pipe with elliptical or quadrant reinforcement, the letter E or Q.

E. Inspect pipe for defects prior to placement in trench. The pipe and fittings shall be free from visible cracks, holes, foreign inclusions or other injurious defects.

F. Assure that all materials are of the type specified and are not defective. Unmarked pipe or pipe and materials not meeting Specifications requirements shall be removed from the site as directed by the Engineer.

3.02 INSTALLATION

A. Fine grade trench bottom so that pipe is supported for its full length.

B. Install piping beginning at the low point of the system, true to grades and alignment indicated on the Plans. Place the bell ends of the pipe facing upstream.

C. Do not lay pipe on unsuitable material, in wet trench, or in same trench with another pipe or utility.

D. General Procedure for Joining Pipe

1. Do not use excavating equipment to force pipe sections together.
2. Hold pipe securely and in proper alignment when joining.
3. Do not disturb previously made joints. Check completed piping to assure joints are intact. Insure placement of backfill over pipe is accomplished without disturbing pipe position.
4. Do not allow earth, stones, or other debris to enter pipe or fittings.
5. Method of installing joint materials and joining piping shall be in strict accordance with manufacturer's printed instructions.

E. Polyethylene pipe shall be installed in accordance with the manufacturer’s written instructions or as directed by the Engineer. Joints for all polyethylene pipe 12-inches in diameter or greater shall be watertight in accordance with ASTM D3212. Gaskets shall meet the requirements of ASTM-F477.

3.03 BACKFILL AND COMPACTION

A. Bedding and Initial Backfill
1. Bedding and initial backfill shall be in accordance with the manufacturer’s written instruction or, in absence of said instructions, in accordance with Section 31200 of these Specifications.
2. Install initial backfill material as shown on the Plan details for the type of pipe used.
3. When required, material shall be placed under the pipe haunch to provide adequate side support. Material shall be installed for entire trench width and shall be tamped and rodded to insure full contact with pipe at haunch up to the spring line.
4. Little or no tamping of the initial backfill directly over the pipe shall be done.

B. Final Backfill
1. Final backfill shall be in accordance with Section 312000 of these Specifications.

3.04 CATCH BASINS, MANHOLES, AND YARD DRAINS

A. Catch basins and manholes shall be installed in accordance with Section 708 of the Standard Specifications.

B. Installation of rubber gaskets for precast catch basins and manholes shall be in accordance with the manufacturer's recommendations.

C. Frames shall be well bedded in mortar, making a watertight joint. Cover and frame shall have a shop coat of asphaltic pitch and shall have a field coat of similar paint after the frame is set in final position.

D. Repair and adjustment of catch basins and manholes shall be in accordance with Section 602 of the Delaware Department of Transportation Standard Specifications for Road and Bridge Construction.

E. Yard drains shall be installed in accordance with the manufacturer's written instructions. Backfill material and methods shall be as specified for plastic pipe. Compact around the yard drain to prevent settlement over time.

END OF SECTION

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